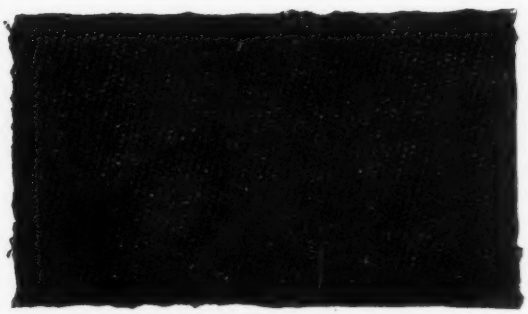
AMERICAN
DYESTUFF
REPORTER

GEIGY COMPANY, Inc.

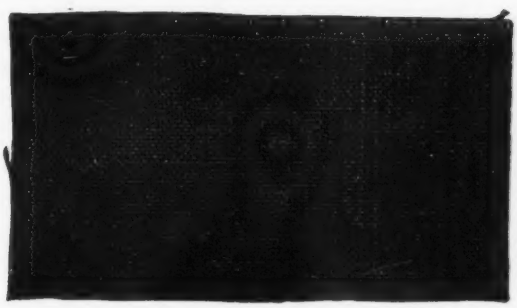
89-91 Barclay Street
New York City

ANILINE COLORS



POLAR RED B CONC

Is another new type of the Polar line, which line needs no introduction to those who have had the pleasure of working with it. Polar Red B Conc. possesses all the excellent fastness qualities of its family, and, therefore, is particularly well suited for loose wool, slubbing, fancy yarn, knitting yarn, or any type of yarn dyeing where fastness to light and washing and brightness are required. Nothing but the straight Acetic Acid and Glauber Salt method need be used.



DIRECT BLUE 3 R X

Is a reddish Navy Blue of high concentration. This asset, together with its leveling qualities and low price, makes it well adapted where low dyeing cost is the principal requirement. Direct Blue 3 R X produces splendid results when dyed in the machine.

Sole Selling Agents for J. R. GEIGY S. A., Basle, Switzerland
Established 1764.

Main Office J. R. Geigy S. A., Basle, Switzerland; in Great Britain
The Geigy Colour Co., Ltd., 35-37 Dickinson St., Manchester

BOSTON PROVIDENCE PHILADELPHIA TORONTO COLUMBUS, GA.

DUPONT

VAT | ACID | CHROME | BASIC | SULFUR | DIRECT

DYESTUFFS

Developed Colors

FOR

Cotton

Pontamine Diazo Scarlet A
Pontamine Diazo Scarlet R
Pontamine Diazo Red 7 BL
Pontamine Diazo Bordeaux 7 B
Pontamine Diazo Blue M
Pontamine Diazo Orange
Pontamine Diazo Black BH Conc.

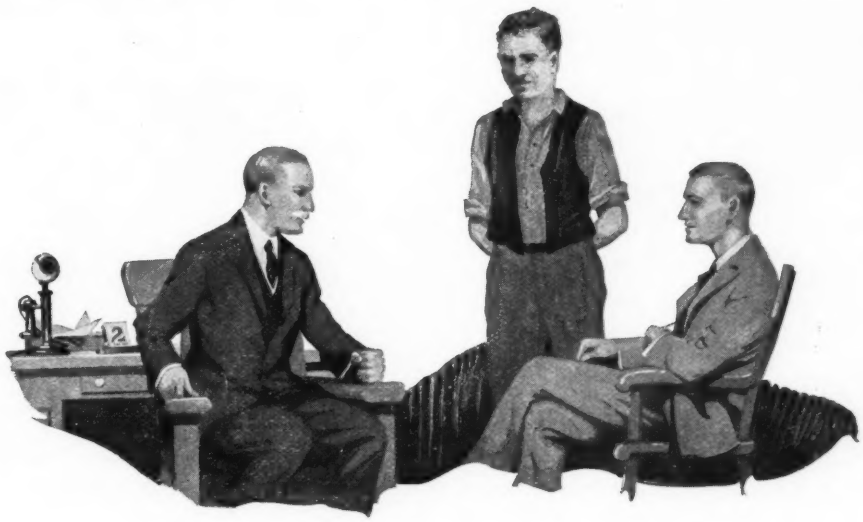
These dyestuffs as self-colors or in mixtures produce a range of exceptionally fast shades on cotton.

E. I. du Pont de Nemours & Co., Inc.
Dyestuffs Department
WILMINGTON, DELAWARE

Branch Offices:
New York Boston Providence
Philadelphia Chicago
Charlotte, N. C.

STANDARD DU PONT DYESTUFFS UNIFORM

American Dyestuff Reporter, Vol. XI, No. 13. Dec. 18, 1922. Published biweekly by Howes Publishing Co., Woolworth Building, New York N. Y. Domestic subscription, $5.00; Canadian, $5.50; foreign, $6.00. Entered as second-class matter Nov. 6, 1919, at the New York, N. Y. Post-office, under the Act of March 3, 1879. Copyrighted, 1922, by Howes Publishing Co.



The Deciding Factor

HOW to operate at a fair profit without further reduction in wages was the question before the informal conference at Blank Mills.

Agent:—"I've bought up on raw stock for the next six months. I'm convinced that the bottom of the market has been reached and all market forecasts predict an advance before long."

(Then the agent's brow clouded.)

"But it'll have to advance quite some to make us a profit and we shouldn't depend on it anyway. (Turning to superintendent.) Johnson, are you convinced that our equipment is capable of producing at minimum cost?"

Supt.:—"Absolutely. Look through the advertisements in any textile paper today and you will not find any improved machinery that's made a reputation for itself that we haven't got in our mill."

Boss Dyer:—"Excuse me, Mr. Johnson, but I'll have to qualify that statement of yours. I don't doubt but what we've got all the up-to-date machinery we need in most departments of the mill, but when it comes to the dye house I KNOW we haven't."

Supt.:—"Oh, well, that end of the job is up to you."

Boss Dyer:—"Exactly, and that's why I asked to be called in on this conference this morning. I want to say that no matter how you look at it, we ought to install Franklin Package Dyeing Machines."

Agent:—"And your reasons?"

Boss Dyer:—"Well, all you have to do is to look at a Franklin Machine to see that it takes about half the space of one of our vats. You know we need extra space.

"Then a Franklin Machine, dyeing in a steamtight kier under pressure, uses only one gallon of liquor to a pound of yarn. As a very conservative estimate this will save us several thousands a year in fuel and water. And your labor,—with Franklin Machines it doesn't have to be skilled labor and the production per man is much greater,—several more thousands a year saved."

Supt.:—"Even so, those savings will not allow us a profit at present market prices."

Boss Dyer:—"Quite so. Strange as it may seem, the greatest saving which Franklin Machines make is not in the dye house, but in eliminating expensive and wasteful methods of backwinding. If you use Franklin Dyeing you can substitute simple, direct methods of winding which in many cases have saved as much as 5 cents per pound of yarn dyed. On a basis of one million pounds per year this means an annual saving of $50,000. Suppose we only save 2 or 3 cents per pound, isn't it worth while?"

Supt.:—"Granted, BUT—(and the superintendent smiled)—are you sure that they will give us as good colors as we're getting now?"

Boss Dyer:—"Absolutely! (with an answering smile and imitating the superintendent's emphasis on the same word somewhat earlier in the conversation). Look at these samples and judge for yourself."

Agent (to superintendent):—"Johnson, I guess our boss dyer goes to the head of the class. These are some of the most brilliant and solid colors I've ever seen."

Supt.:—"Yes, I take my hat off to 'our boss dyer'—and to the Franklin Process Company too. I got the idea somehow that Franklin Machines couldn't do a top-notch job on our class of work, but these colors are better than what we're turning out now."

Agent (to superintendent):—"Very well. The meeting is adjourned. I'll get in touch with Franklin Process Company right away and if the proposition is what it certainly looks to be, we ought to be able to get production back on a paying basis and still maintain our present wage scale."

Have YOU investigated the money saving possibilities of Franklin Dyeing Machines? When they are already saving thousands of dollars for many of the best known mills in this country and abroad, it seems probable that they can do as much for you.

We will furnish full particulars on request without obligations on your part. Advise what you wish to dye and we will send you the proper circular and other information.

FRANKLIN PROCESS CO.

Philadelphia PROVIDENCE Manchester, Eng.

New York Office, ?? Leonard Street

SOUTHERN FRANKLIN PROCESS CO.

Greenville, S. C.

QVALITY COLORS
UNITED STATES COLOR AND CHEMICAL CO. INC. ©

Anthranol Chrome Blue Black AR

Dyes chrome mordant or top chromed. Recommended for fast shades of navy blue or all classes of stock. On account of its shade, level dyeing properties and solubility it is especially suitable for piece dyeing

Anthranol Chrome Brown W

Dyes chrome mordant or top chromed. Is fast to light and fulling. The most level dyeing brown on the market.

Acid Chrome Blue F 4 B

Similar to the pre-war Chromotrope F 4 B. Of special interest for dyeing piece goods to leave silk white.

United States Color & Chemical Company, Inc.

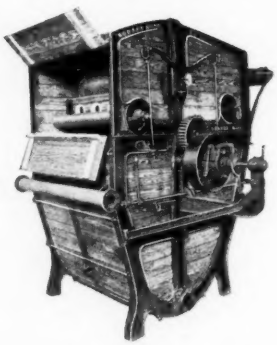
93 Broad St. Boston, Mass.

New York Office: 25 Howard St.

FACTORIES:
NEW ENGLAND ANILINE WORKS, Inc.
Ashland, Mass.

GARFIELD ANILINE WORKS, Inc.
Garfield, N. J.

STANDARDIZE
on
Rodney Hunt Washers



(*Ask for Booklet 221*)

Scouring and Rinsing

Woolens, Worsteds, Cottons, Knit Goods

Rodney Hunt Machine Co.
40 Mill Street Orange, Mass.

I. LEVINSTEIN & CO.
INCORPORATED

281-5 Franklin Street
Boston, Mass.

offer a
full line of
American made
and
British made

DYESTUFFS

They represent
British Dyestuffs Corporation, Ltd.
Manchester, England
They are introducing to this country

DUROPRENE — *An acid and alkali proof varnish*

VELVONA — *A new inert base and filler*

MATHIESON Chemicals

Caustic Soda in Liquid Form

99% NaOH
GUARANTEED

MANY manufacturers are now using caustic soda in liquid form.

They have found that the use of liquid caustic effects a worth-while saving over the use of the solid material packed in drums. It reduces the cost of handling and dissolving.

Mathieson Liquid Caustic Soda — analyzing less than 0.50% of Sodium Carbonate, less than 0.20% of Sodium Chloride, less than 0.07% of Sodium Sulphate; permitting us to guarantee a minimum of 99.00% Sodium Hydroxide — is shipped in tank cars from Niagara Falls in a non-freezing solution averaging 25% of Solid Sodium Hydroxide, or about 32 degrees Baumé.

The use of Mathieson Liquid Caustic Soda assures you economical operation and uniform results, at the same cost.

The MATHIESON ALKALI WORKS Inc.
25 WEST 43rd STREET NEW YORK CITY

PHILADELPHIA
PROVIDENCE

CHICAGO
CHARLOTTE

Deal Direct with the Manufacturer

The Extractor with One Moving Part

FLETCHER
ELECTRIC UNDERDRIVEN
EXTRACTORS

are **"practically indestructible,"** according to a prominent hosiery manufacturer who owns six of these machines.

Maintenance cost is reduced to a positive minimum by the absence of clutches, couplings, belts and gears.

You should know more about this modern extractor. Write for Bulletin 11A.

FLETCHER WORKS **INCORPORATED**
Formerly Schaum & Uhlinger
Established 1850

GLENWOOD AVENUE, AT SECOND STREET, PHILADELPHIA, U. S. A.

New England Representatives: HURRICANE ENGINEERING COMPANY, 53 STATE STREET, BOSTON, MASS.
Western Representatives: R. R. STREET & CO., 28 N. CLINTON STREET, CHICAGO, ILL.
Southern Representative: H. MORSHEAD, GLENWOOD AVENUE and SECOND STREET, PHILADELPHIA, PA.

TECHNICAL BOOKS

If you are in the market for books on technical subjects — dyeing, finishing, bleaching, etc. — communicate with us and it is probable that we can supply your needs. We shall at all times be glad to submit lists of books covering any special lines.

We call particular attention to

A TEXTBOOK OF DYE CHEMISTRY
By G. VON GEORGIEVICS

This is a new edition of a former volume by the same author, entitled "Chemistry of Dyestuffs," and has been thoroughly revised and brought down to date by Dr. Eugene Grandmougin—translated by Frederick A. Mason. The new edition describes minutely the chemical properties of all dyestuffs, including the natural colors, and contains particularly a new chapter on the Vat Colors

PRICE $12.50

DYERS' MATERIALS
By PAUL HEERMANN

An introduction to the examination, valuation and application of the most important substances used in dyeing, printing, bleaching and finishing. Translated by Arthur C. Wright. Second edition, revised and enlarged by H. B. Stocks. **PRICE $3.00**

HOWES PUBLISHING CO.
4109 Woolworth Building **NEW YORK CITY**

SANDOZ

ANILINE DYES FOR ALL TRADES

SANDOZ

We carry a complete line at all Branches

For samples and prices apply at any of our offices

SANDOZ CHEMICAL WORKS
INCORPORATED

238-240 Water St. NEW YORK
12 So. Front St. PHILADELPHIA
36 Purchase St. BOSTON
175 Market St. PATERSON
Commercial Bank Bldg. CHARLOTTE, N. C.

NAPHTHOL YELLOW
AZO YELLOW

and a general line of dyestuffs manufactured by
CONSOLIDATED COLOR & CHEMICAL CO.
CENTRAL DYESTUFF & CHEMICAL CO.
WILLIAMSBURG CHEMICAL CO.
and other American manufacturers

INDANTHRENE
THIO-INDIGO
HELINDONE
HYDRONE
ALGOL

and other dyes, will be imported by us direct from the manufacturers

FARBWERKE VORM. MEISTER, LUCIUS & BRÜNING
FARBENFABRIKEN VORM. FRIED. BAYER & CO.
CHEMISCHE FABRIK GRIESHEIM-ELECTRON
BERLIN-ACTIEN GESELLSCHAFT FÜR ANILIN-FABRIKATION
LEOPOLD CASSELLA & CO.
FARBWERKE-MÜHLHEIM
KALLE & CO.

H.A.METZ & CO. Inc.
One-Twenty-Two Hudson Street, New York City.
Boston Philadelphia Providence Chicago Charlotte San Francisco

N. T. Y.

INDOPHENAL BLUE

ALL SHADES

FROM SKY BLUE TO BRILLIANT REDDISH TYPE

These products are especially adapted to all kinds of dyeing where a better grade of Sulphur Color is required

They are distinguished by their excellent solubility, fastness to light, washing, rubbing, alkali and acid.

MADE BY

TOWER MANUFACTURING CO., Inc.

DYESTUFFS DEPARTMENT

SALES OFFICE AND FACTORY
85 to 105 DOREMUS AVENUE NEWARK, NEW JERSEY

"SILK BROWN G"

A new, level dyeing, fast acid color for Wool or Silk. Also an excellent neutral dyeing color. Dyes Silk or Wool in neutral or even in slightly alkaline bath.

Heretofore the shading of light colors on silk or wool in a neutral bath was usually accomplished with red and yellow, with results far from satisfactory.

"SILK BROWN G" brings relief to the union dyer as a mellow brown to shade greys and light fancy colors on silk or wool in union, as well as a ground color for Tan, etc. Is extremely level dyeing either when dyed in an acid bath or neutral bath.

"Silk Brown G"

Manufactured only by

ALTHOUSE CHEMICAL COMPANY, *Office and Plant: READING, PA.*

Established 1815

ARNOLD, HOFFMAN & CO., Inc.

PROVIDENCE, R. I. NEW YORK, N. Y. BOSTON, MASS.
PHILADELPHIA, PA. CHARLOTTE, N. C.

Importers and Manufacturers of

SIZING, SOFTENING and FINISHING SPECIALTIES

FOR ALL

TEXTILE FABRICS

Sole Agents for

BELLE ALKALI COMPANY, of BELLE, W. VA.

Manufacturers of LIQUID CHLORINE and CAUSTIC SODA (Solid and Flaked)
BLEACHING POWDER

ESSEX DYESTUFFS

DIRECT YELLOW CF	DIRECT FAST BROWN M	DIRECT PINK SX
CHRYSOPHENINE CONC.	DIRECT ORANGE R	DIRECT FAST SCARLET B
DIRECT YELLOW 2G	DIRECT ORANGE 2RE	ERICA 2GN
DIRECT FAST YELLOW B	DIRECT ORANGE 5RE	DIRECT ROSE FFB
COTTON YELLOW 5G	DIRECT PINK NY	DIRECT ROSE NB
DIRECT BROWN 2R	DIRECT PINK 2Y	DIRECT GREEN 2B
DIRECT BROWN 2Y		CHROME GREEN B CONC.

ESSEX ANILINE WORKS, Inc.

Manufacturers of Aniline Colors.

88 Broad Street, Boston, Mass. Factory at South Middleton, Mass.

The Grasselli Chemical Co., Sole Sales Agents, 117 Hudson St., New York City

DYESTUFF IMPORTATION

The removal of the Dyestuff Embargo has created an entirely new condition which we must face.

Having in mind the interests of the Dyestuff Consuming Industries who require **foreign-made colors** as well as those made by **American Dyestuff Manufacturers,** we have organized an **Import Department** and are now in a position to supply such products.

Being thoroughly familiar with the foreign range of Dyestuffs, past and present, we solicit inquiries.

As MANUFACTURERS and IMPORTERS we are ready and able to meet the most exacting requirements of Dyestuff Consumers.

Samples and Prices Cheerfully Furnished

JOHN CAMPBELL & COMPANY

75 Hudson Street ESTABLISHED 1876 **New York, N. Y.**

Branches:

Boston **Providence** **Chicago** **Philadelphia** **San Francisco** **Toronto**

F. E. ATTEAUX & COMPANY, Inc.

172-178 Purchase Street, Boston

Sole Selling Agents for

Palatine Aniline & Chemical Corp.

Poughkeepsie, New York

New Product

Empire Coralline—for Wool and Silk

Brilliant color of exceptional fastness to light and milling.

F. E. ATTEAUX & COMPANY, Inc.

BOSTON NEW YORK PHILADELPHIA CHICAGO

ARKANSAS CO., Inc.

253 Broadway

New York City

Manufacturers of

ANTHRACHROME MORDANT

ANTHROLIC ACID

Reg. U. S. Pat. Off.

ANTHRAPOLE OIL

ANTHROLE OIL

THEANTHROLE

S. R. DAVID & COMPANY

INCORPORATED

Dyestuffs

252 Congress Street, Boston, Mass.

Hartford Office: 1029 Main Street

Tel. Main 1684

Latest 1914 Berlin Edition of

"FARBSTOFFTABELLEN"

By Dr. Gustav Schultz

Containing over 1000 dyestuff formulæ reprinted and exactly reproduced by photographic process on fine white paper, and substantially bound in heavy black cloth and leather.

Can now be had from us at $10 per volume.

HOWES PUBLISHING COMPANY

4109 Woolworth Building, New York

Contents of This Issue

December 18, 1922

Hosiery Dyeing 441
Arthur T. Brainerd and Walter E. Brainerd

The Physical Chemistry of Dyeing. Acid and Basic Dyes 447
T. R. Briggs and Arthur W. Bull

Proceedings of the American Association of Textile Chemists and Colorists..... 451

Index to Volume XI 453

Index of Proceedings of the American Association of Textile Chemists and Colorists. 457

Editorials 459

Bleaching and Dyeing Tussah Silk..... 463
George Emmons

Chromates of Lead in Dyeing and Calico Printing 467
W. B. Nanson

Notes on the Dyeing of Direct Blacks on Cotton Piece Goods (Part IV)..... 471
Raffaele Sansone

Bleachers!

"Better fabrics" is the cry. You want to start by giving them a Better Bleach.

The goods should be given a permanent white without weakening, of greatest elasticity and softness.

Only Peroxide bleaching can do all this, without increase in cost.

Ask us how.

THE ROESSLER & HASSLACHER CHEMICAL CO.
New York

The Leaders in their Field—
National Direct Blacks

The "National" manufactures a dozen types in the Direct Black class, chief among which are the following:

National Erie Black GXOO

The most largely used of all, giving a jet black of greenish shade. In common with other types in this group it is soluble, level dyeing, generally fast, particularly when after treated, and is suitable for dyeing cotton, wool, unions, hosiery, silk, leather, and paper.

National Erie Black B Extra

Yields a bright and bloomy shade not so jet as National Erie Black GXOO nor so red as National Erie Black RXOO.

Among those giving reddish shades are

National Erie Black RXOO

and

National Erie Black N R Extra

possessing fastness to acid, which is also better suited for dyeing full shades on the jig: for dyeings in the fulling mill, for speck dyeing and for filling the cotton in union dyeings.

"National" Service

The "National's" aim is not merely the sale of dyes but the certainty of satisfactory results in their use. To this end we maintain a staff of practical dyehouse experts and completely equipped laboratories at each branch office, the services of which are always at the disposal of the user of dyes.

National Aniline and Chemical Company, Inc.

New York *Chicago* *Charlotte* *Toronto* *Philadelphia*
Boston *Hartford* *Montreal* *Providence* *San Francisco*

AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the practical application of dyestuffs in all industries; especially to textile chemistry—the science and practice of scouring, bleaching, dyeing and finishing.

VOLUME XI NEW YORK, DECEMBER 18, 1922 NUMBER 13

Hosiery Dyeing

Growth of the Hosiery Industry—New Problems Facing Manufacturer and Dyer—Variety of Fibers to Be Dyed—Cotton—Cotton and Silk—Wool—Wool and Silk—Wool and Cotton—New Dyestuffs Available—Importance of Preparation and Finishing

By ARTHUR T. BRAINERD and WALTER E. BRAINERD

Respectively of H. A. Metz & Co., Inc., Chicago, Ill., and of the Holeproof Hosiery Company, Milwaukee, Wis.

PROBABLY no industry in America has exceeded, in substantial growth, the remarkable development of the hosiery business during the past few years. A great many new firms have been organized, most of which have been successful, and practically all of the mills already established in 1914 have shown continued expansion. In a letter to the bankers written by the president of one of the largest hosiery manufacturers regarding financing for further development, it was remarked that never in its fifty years of existence had that business been able to fully take care of its customers' requirements.

Exact production figures are not available for the post-war-boom year of 1920, and during that year the value of all hosiery produced probably reached its highest point, but the figures for 1919 show the extent of the growth over a five-year period. According to census reports of the Department of Commerce the value of all hosiery produced in knit goods factories increased from $98,098,540 in 1914 to $308,662,377 in 1919. About one-half of the latter amount represents the sale of unmercerized and mercerized cotton hose and half hose. Of the remainder about 85 per cent was of silk and silk mixed, a large proportion being the familiar thread silk with cotton tops, heels and toes. Many individual plants, particularly silk hosiery manufacturers, undoubtedly produced their largest yearly volume in 1921, prevailing styles in skirts being of immense advantage to the hosiery business.

In so important and growing an industry, a review of the essential points in the dyeing operation will perhaps be of interest to both manufacturer and dyer. Many new problems have been met and solved. Many are still the source of difficulties, but these are being straightened out day by day by good keen thinking and the proper application of fundamental principles of dyeing.

Cotton

In spite of the fact that cotton hosiery is never seen any more, there is still a large quantity being manufactured and dyed. Many mills specializing in children's cotton hose are enjoying prosperity along with the manufacturers of nationally advertised silk hosiery. Cotton hosiery dyeing is fundamental. It constitutes a practice of the first principles of the hosiery dyeing profession and a knowledge of the equipment, materials and processes used in all other lines. For purposes of discussion it may be divided into three groups, viz.:

Black
Colors
White

Black on cotton hosiery is dyed with one of the following: Direct Black, Aniline Salt or Oil, or Sulphur Black. A relatively small percentage is dyed direct as other methods produce faster colors at little or no increase in cost. Aniline Black is no longer produced on hosiery in the large quantities of former years on account of the complicated process. Many manufacturers believe it to be the best black ever produced for hosiery and strive to imitate its shades, but it is probably generally conceded that the oxidation process necessary is not practicable for the quantity production of hosiery. A two-bath method, with a long drying process is necessary for best results and there is much danger of imperfect dyeing.

The Sulphur Black dyeing is for most mills the only important item as far as blacks on cotton are concerned. Much has been written on the subject and the process, so universally used, is well known. Many dyers consider it a trick of operation and almost everyone has pet ideas for improving shades produced and for manipulation of

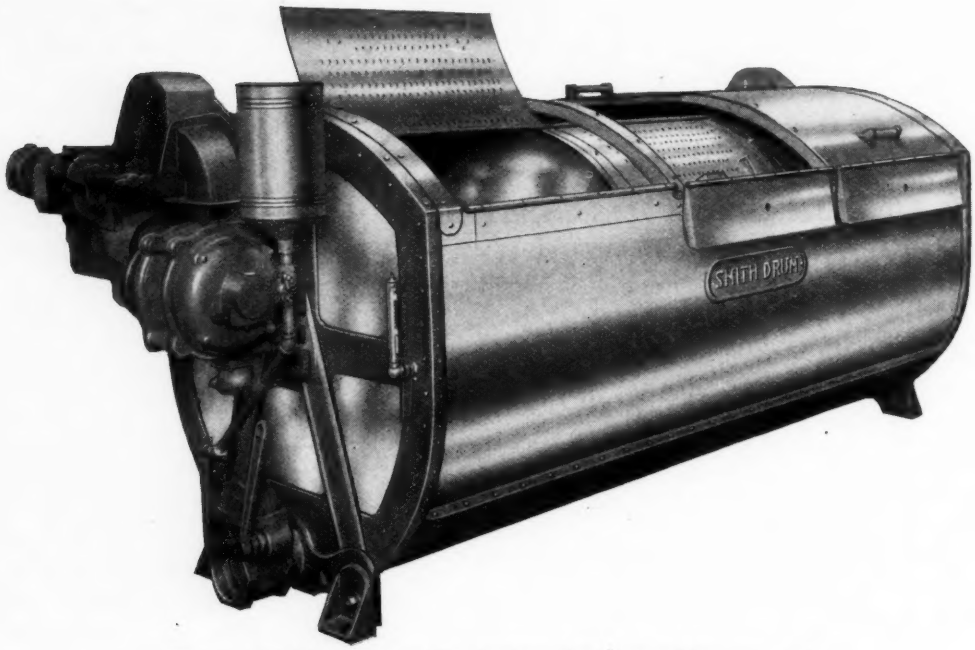


FIG. 1—*Smith, Drum & Co. hosiery dyeing machine, new type*

the goods in process. The chief requisites are a revolving machine of basket type, either with removable basket and supplementary machines for the finishing process, or a pump for removing and tank for storing dye liquor while finishing (see *Figs.* 1 and 2). The object of such equipment is, of course, the keeping of a standing bath, as Sulphur Black exhausts only about 50 per cent of dyestuff and less of chemicals. The amount of dyestuff used depends on the depth of shade desired and the material in work. Six to eight per cent (standing) of the concentrated blacks now on the market is recommended for mercerized hosiery and about twice that amount for unmercerized. A large percentage of dyestuff is of great importance for production of good shades on coarse, unmercerized goods, such as children's hose. Necessary amounts of sulphide, soda and salt are added so that the dyestuff is always in complete solution and density of the bath is correct. The usual method of testing density is to remove a graduate full of dye liquor and allow it to cool. The bath prepared for dyeing should be up to 9 to 10 deg. Tw. when cooled. This will run about 3 deg. Tw. hot (at the boil). The goods are entered at the boil and dyed at the boil for one hour, well rinsed and finished. Rinsing Sulphur Black means four or five waters (hot or cold) as it is essential that all traces of sulphide be removed to guard against tendering of goods. It is largely in the finishing that individual ideas are put in practice and the process is of much importance for here, to a great extent, the beauty of the final shade is produced. There are many patent finishes on the market, all of which are probably good but not all suitable for a particular grade of goods or a particular working condition. The essential of a Sulphur Black finish is an ingredient for removing all excess dyestuff (thus avoiding bronze spots and streaks), softening the material, and giving luster and clearness to the shade. Soaps, soluble oils, some salts, some acids or combinations of two or more of these are used as finishes.

COLORS

CORDOVAN, GRAYS AND BLUES

Colors other than black for cotton hosiery are chiefly brown and navy blue. Brown shades vary with the fashionable shades in shoe leather, cordovan and African browns being leading colors to-day. Direct cotton dyestuffs are most largely used on account of low cost and ease of application. To insure level dyeing and penetration the goods are well wet out before being entered in the dye bath. Boiling before dyeing is very important in many varieties of cotton material and should be dispensed with only where there is no possibility of inferior results. In hosiery dyeing, it is unsafe to go ahead without previous wetting except when dyeing Sulphur Black. When handling long stockings of any description it is advisable to shake out after the boil out to avoid tangling and a resultant uneven dyeing.

Dyestuffs chosen for colors on cotton hosiery should be selected according to working qualities and fastness to washing. Evenness of shade and uniformity of results are essential, but as most hosiery of this class is sold at low prices, the cost of dyeing is given serious consideration. Increased fastness could be obtained by using aftertreated or diazotized and developed colors, but the added expense is not generally considered justifiable. Sulphur browns and blues have been recommended to some extent, but considerable trouble is experienced in their application. The Sulphur Blues are particularly

difficult to handle on account of the formation of bronze spots caused by uneven oxidation.

Much all-cotton hosiery is bleached, particularly by manufacturers of children's hose. The process used is the chloride of lime bleach or the application of a solution of chlorine gas. The operation is carried out exactly as in skein bleaching, cement tanks being used. Of course, every possible precaution against tendering must be taken.

Silk and Cotton

Cotton and silk and all-silk hosiery, being the most expensive produced, occupy a place of chief importance with manufacturers of the highest grade of hosiery. During the past few years the demand for silk hosiery has grown to such an extent that mills have been called upon for constantly increasing production. As this has necessitated plants of larger capacity and expanding organizations, it has been essential for each superintendent to carefully control all operation of manufacture, for only by so doing could the invaluable uniformity of product be obtained. Requirements are exacting and dyehouse methods must be precise.

The first step in dyeing silk hosiery is the boil-off, whereby the gum is entirely removed from the silk fiber.

Fig. 2—*Another type of Smith, Drum & Co. machine, showing how the basket may be removed*

Fig. 3—*The Clenzall dyeing machine of the Klauder-Weldon Company*

This process must be given constant, careful attention, as it is here that much of the fine appearance and durability is preserved. The degumming should be carried out in such types of machines as do not excessively "tumble" the hosiery in order to avoid straining and injuring the silk. If boiling off is done in the rotary type laundry machine, the process must be completed in as short a time as possible. Rubbed effects, detrimental to both appearance and durability, show on the finished hosiery if the material is run too long.

The highest grades of olive oil soaps should be used, as cheaper soaps containing free alkali produce injurious effects. In order to preserve the life and elasticity of the silk fiber excessive boiling must be avoided. About 10 per cent of soap is used and the goods are treated for one to two hours at the boil. This is followed by three hot rinses in order to remove all the soap.

Developed Black

Black is by far the greatest seller in silk hosiery to-day. Machines turning out up to 500 pounds per batch are generally used for this color. Either the Hussong (circulating) or some rotary drum machine is suitable, as either type handles large quantities with uniform results. A standing bath is used as this results in a saving of about 25 per cent of dyestuff. A large storage tank for the dye liquor is used if the type of machine so necessitates. During the past few years Direct Black has been universally used, but since the recent introduction of Developed Black, this product, due to its superior fastness to washing has largely superseded Direct Black.

The dyeing of Developed Black is a long procedure, the entire operation requiring about five hours. For this reason the dyeing of the finest grades of silk hosiery can probably be carried on with less harmful results in such types of machines as circulate the dye liquor. One machine may be used throughout the entire process, but a series of machines is advisable. When using a series, the removable basket may be lifted after the dyeing and carried on the track to the second and third machines for subsequent treatments.

The dye bath is made up with about 6 per cent dye-

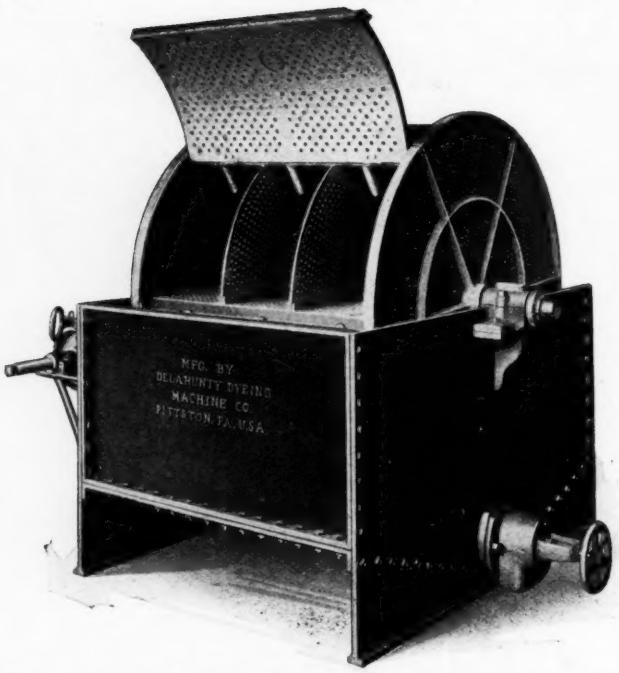


FIG. 4—*No. 0 hosiery dyeing machine of the Delahunty Machine Company; cylinder divided into six compartments; capacity, 250 to 300 pounds*

stuff for standing bath, and the requisite amount of common or Glauber salt added. The goods are entered and the bath brought to a boil. The boiling is continued for one hour. This is followed by two or three cold rinses. The goods are then diazotized in a cold bath containing 3 per cent sodium nitrite, 3 per cent sulphuric acid or 6 per cent hydrochloric acid. Care must be taken not to use too much acid so that the subsequent developing bath will easily neutralize any excess acid and still remain alkaline. Acid in the developing bath results in the formation of Bismarck Brown, which gives a rusty tone to the black and impairs its fastness. After twenty minutes' run the goods are given two or more cold rinses, and then developed in a cold bath containing 1 per cent developer and 1 per cent caustic soda. Recipes for some blacks call for soda ash instead of caustic soda; others require some of each. After twenty minutes' run in the developing bath the goods are given a cold rinse. The goods are now ready for the finishing. This latter may be accomplished by a number of different methods. Generally some emulsified oil or soap finish is given, either in conjunction with acetic acid or with a separate final acetic acid scroop. The finishing process removes any excess of dyestuff and acts as a final developer, thus making the results truly fast. Moreover, it is in the finishing bath the desired elegance of appearance is obtained. Much experimental work has been done to produce the present excellent standard and chemists are constantly searching for further improvements.

Of next importance are the Cordovan Browns. In dyeing colors on hosiery best results seem to be produced with rotary type machines. Quantity production is now essential so formulas and procedure should be exact. The hosiery dyer must avoid the necessity of making additions to the dye bath because his goods are so tangled that, even if the bath is cooled, he is unlikely to have his added color penetrate the entire lot. If batches are off shade when sampled the goods must be removed from the machine, shaken out, and re-entered in the cooled bath to which the dyestuff has been added. Shading being so difficult, proper precautions must be observed in preparation and dyeing. A sample should always be taken from the degumming bath and dried. By stretching the silk one can readily ascertain whether the gum is entirely removed.

The action of dyestuffs used for silk and cotton unions depends largely upon the water used in dyeing. Most of the direct colors dye silk deeper than cotton in hard water at the boil, making a correction with soda ash advisable. Soap is not suitable, as the insoluble lime soap formed is certain to cling to the silk goods, causing disastrous streaks which will have the appearance of grease or wax after being rubbed by the hand of the operator in the boarding room. Best results are undoubtedly obtained in soft water, as the cotton is readily and evenly dyed and the depth of shade on silk can easily be regulated by choice of dyestuffs, amount of salt, and length of boil. Dyestuffs which will produce good unions should be selected. Some shading is necessary, but usually the shading colors needed will be direct colors which dye cotton exclusively. Dyeing is started

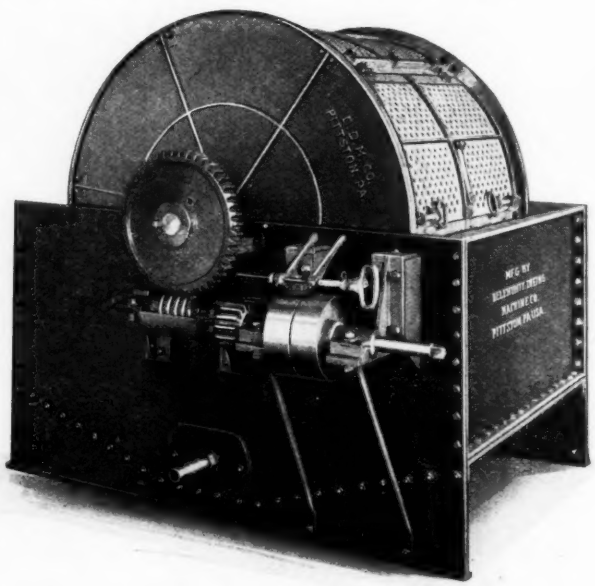


FIG. 5—*Showing drive of Delahunty No. 0 machine. Cylinder can be divided into two, four or six compartments*

at 123 deg. Fahr., temperature raised rather rapidly to the boil and boiling continued for half an hour. Finishing consists only of rinsing and a final scroop. Due to irregularities in stock, knitting, or dyeing some variation in shades will be found within each batch. Careful mating is essential before packing for shipment.

Direct colors of superior fastness to washing, dyed direct or aftertreated, have recently been introduced. Aftertreatment of hosiery, particularly ladies' goods, is undesirable if any change of shade occurs in the bath containing metal salts, but very satisfactory results are obtained by the use of the better class direct colors without treatment after dyeing. As comparatively little increase in cost is encountered in the use of the faster colors their adoption will gradually become quite universal.

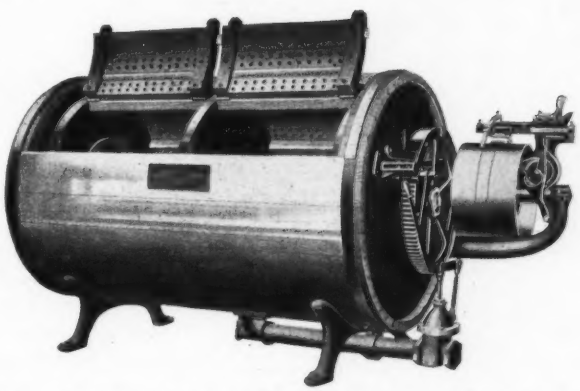


FIG. 6—*Revolving laundry machines similar to the one here illustrated (Troy Laundering Machine Company) are frequently used for hosiery dyeing*

LIGHT SHADES

The demand for the various light shades has increased considerably in the last few years and it has been a difficult problem for the hosiery dyer to produce good unions and level results in these shades. A standard formula must be developed as it is impossible to make addition of dyestuff in a hot bath or upon hosiery which has become tangled by tumbling in a rotary machine. Probably the best method of dyeing light shades is by the almost exclusive use of direct colors, although acid and small amounts of basic colors may be used for shading. Most hosiery dyehouses use soft water which is alkaline in reaction. This eliminates the use of neutral dyeing acid colors unless considerable salt and some acid is added. Very little salt should be used because the cotton is dyed quickly and the color will not boil level in a salt bath.

Probably the greatest difficulty is to get the toes and heels of the stocking thoroughly penetrated. When light shades are dyed in a bath containing any salt these parts are not penetrated and blotchy effects appear. Some mills attempt to eliminate this difficulty by "pounding out." This means that after boiling out and extracting, the stockings are picked out, a few at a time, and given a sharp crack across a horizontal bar or other structure. This is an expensive procedure demanding much time and labor. Pounding can be eliminated by adding a small quantity of direct color (probably 20 per cent of the total formula) to the boil-off bath along with the soap. This dyestuff does not touch the silk, so it virtually gives the cotton a "start." Such starting has not worked out satisfactorily when boiling in laundry machines, as the hosiery is packed in nets and circulation is poorer than in a dyeing machine. If laundry machines are used it is more advisable to apply the dyestuff for the cotton start in a separate bath immediately after the soap boil-off. After the cotton parts have been given a start the hosiery is shaken loose, and the dye bath is prepared. When dyeing light shades it seems to be necessary to make up the dye bath with all ingredients thoroughly mixed before the goods are entered. Dyeing should be started cold or lukewarm and the temperature raised very gradually to the boil.

Many conditions, ordinarily of slight importance must be carefully controlled, else uneven dyeings will surely be obtained. Steam connections must be so arranged that the heat is evenly distributed throughout the bath. Overloading must be avoided, hence cutting down the size of batches to 60 or 70 per cent of the machine capacity is recommended. Batches must be of approximately this size as too small loads will result in tangle marks, caused by uneven penetration. A long bath is absolutely necessary to prevent premature exhaustion of the rotating drum, the machine being run faster than is ordinarily required for heavier shades, and geared to turn with practically equal length of rotation in each direction.

In choosing the dyestuffs to be used for light shade dyeing, the two chief considerations are level dyeing properties and the production of good unions. Colors which exhaust slowly and level well at the boil should be selected.

DIRECT BLACKS AND GRAYS

Direct blacks and grays similar to the Columbia Blacks and Benzo Fast Blacks are more level dyeing and of better fastness than ordinary Direct Black. The last named color should not be used as a basis for grays or for such tints as Sand and Nude. Direct Fast Gray can be used in combination with Congo Brown, Chrysophenine, Sulphur Blacks, Direct Fast Reds, etc.

WHITE

Silk hosiery which is being prepared for bleaching must have all identification color removed from the silk previous to degumming. This is done by running a short time in boiling water. After boiling off the goods are ready for the actual bleaching process.

Both hydrogen and sodium peroxide are used in

bleaching silk hose—hydrogen peroxide, although more expensive, being the safer. The bleaching is carried on in cement tanks heated by lead pipes. The tanks are filled with hot water and the hydrogen peroxide and a small amount of water glass added. These are thoroughly mixed and the goods entered. Perforated planks are placed over the goods. Two cross planks are placed over these and the tank covered. Two large stone weights are placed over the cover so that the goods are held submerged in the bleach liquor. The temperature of the bleach bath is brought up to 180 to 190 deg. Fahr. and the steam shut off. The bleaching is allowed to go on for six to eight hours. The goods are then removed, washed in hot water and blued. A standing bleach bath should be used. At the end of each bleaching operation a sample of the bleach bath can be titrated against a standard permanganate solution to determine the amount of peroxide remaining. From this can be calculated the amount to be added to bring the bath back to its starting strength. Plaited hosiery requires a little stronger bath than all silk, on account of the larger proportion of cotton to be bleached.

If the sodium peroxide method is used the requisite amount of sodium peroxide is sprinkled slowly and carefully into the bath with constant stirring. The bath is then neutralized with sulphuric acid and the sodium silicate is added. The remainder of the procedure is the same as with hydrogen peroxide.

Wool and Mixed Fibers

Along with the great increase in the sale of silk hosiery has come a tremendous popularity of woolen hose. Aside from the heavy goods, commonly known as lumberman's socks, very little wool or wool mixed hosiery has been marketed for several years, until the recent revival of this branch of the industry. At the present time manufacturers are producing large quantities of all wool, wool and silk, and wool and cotton goods in solid shades as well as every conceivable combination of two-tone and white mixed effects. All-wool hosiery is largely produced in heather mixes. The dyeing for these patterns is done in the stock, chrome colors being used. The dyeing problem is therefore completed when the proper mixture is obtained from the cards, as many mills buy their wool or worsted yarn for these styles. The dyer's problem on all-wool goods is likely to be confined to solid blacks or browns. In such lines all fancy effects are produced either in knitting or by clocking.

Wool and Silk

There is an increasing demand for wool and silk mixes made with a cotton toe and heel. These are made both in solid shades and in two-tone effects. The solid shade can usually be dyed in one bath by the selection of proper union colors and the use of both common and Glauber salt. Temperature control and length of boil play a considerable part in producing solid shade results. Many direct dyes give fast colors on wool when aftertreated in a fresh bath with chrome and acetic acid at a temperature of about 160 deg. Fahr. Direct Browns now on the market are especially suitable for this method.

In order to obtain a full shade of black on wool and silk hose it is advisable to use direct and neutral dyeing Acid Black in combination. These can be dyed in the same bath, acetic acid being added after forty-five minutes' boil to exhaust the bath.

Two-Tone

When two-tone effects are desired the process becomes more complicated. If fast colors are demanded it is necessary to dye the cotton and silk previous to knitting. The cotton is dyed with direct colors and the silk resist dyed. After the hosiery is knit the wool is dyed with chrome colors. The subsequent chroming increases the fastness of the cotton parts, thus making possible a very fast combination. Fairly satisfactory appearance can be obtained on combination goods by dyeing first with a chrome color which will leave silk white. The silk can then be dyed warm with acid or basic colors. Direct colors could be used to color silk in patterns where wool is black. This method does not care for the cotton, which should be yarn dyed before knitting.

Wool and cotton two-tones can be made in one bath by a clever combination of direct, union, and neutral wool colors, but if manipulation is not precise, one fiber is likely to be stained with a dyestuff intended for use elsewhere, which will completely ruin the effect. It is therefore held most proper to handle such work by a two-bath method, dyeing the wool first in an acid bath and afterward "stuffing" or cold dyeing the cotton. In such combinations contrasting tones are usually desired and should be so planned that, with dyestuffs available, best results are produced. For example, orange on wool and blue on cotton; brown or red on wool and green on cotton.

Some popular two-tone effects are produced on cotton and silk plaited hose by dyeing the cotton black and subsequently dyeing the silk various shades. The cotton parts are dyed with Sulphur Black at a low temperature, the silk being still in the gum. An addition of glue to the Sulphur Black bath helps to keep the silk white. After dyeing the cotton the hose is treated in a hot soap bath. This removes the last traces of gum. The silk is then dyed with direct colors. Some two-tone effects on cotton and silk can be produced by dyeing first with direct colors in a soap bath, thus leaving the silk white. The silk is then dyed warm with acid colors that will color silk below the boil. Such results would not be fast and the method would be useful only in production of some high-colored effects.

Other combinations used to a considerable extent are artificial silk with cotton or real silk, and cotton with

(*Concluded on page* 463.)

The Physical Chemistry of Dyeing. Acid and Basic Dyes

Part I

Introductory — Experimental — Materials — Procedure — Determinations of Amount of Dye Adsorbed, Hydrogen Ion Concentration — Adsorption of HCl by Wool — Adsorption and pH of Dye Bath — Addition Agents

By T. R. BRIGGS and ARTHUR W. BULL

A thesis submitted by Arthur W. Bull to the Faculty of the Graduate School of Cornell University in partial fulfillment of the requirements for the degree of Ph.D. Published in the Journal of Physical Chemistry, Ithaca, N. Y.

Introduction

THE various theories which have been proposed from time to time to account for the phenomena of dyeing may be classified, in general, as either physical or chemical. In the latter class are grouped all explanations based on the assumption that a chemical reaction occurs between the dye and the fiber. In the physical interpretation the presence of chemical reactions is denied except in a few special cases, it being believed that in the majority of cases dyeing is due to physical forces or, more specifically, to adsorption of the dye by the fiber.

The adsorption or colloidal theory of dyeing has been summarized and elaborated by Bancroft.[1] Its application to acid dyes[2] may be stated briefly as follows: When any fiber is placed in a dye bath, it may adsorb any or all of the constituents of the bath. (In the case of acid dyes in acidified baths these constituents are hydrogen ions, sodium ions (assuming the dye to have been a sodium salt), anions of the dye, anions of the acid, and undissociated compounds.) Hydrogen ions being, in general, more strongly adsorbed than other univalent cations will be taken up largely and the fiber will become charged positively relative to the solution. This positive charge in turn, will lead to an increased adsorption of anions,[3] and by this secondary process of adsorption the charge on the fiber will be more or less neutralized. The anions of dye and of acid will both be taken up in amounts which are determined for a given fiber by the nature of the ions and by their concentrations. Since, in being adsorbed, the anions of an acid dye have to compete with the other anions of the bath, it follows that the addition of other strongly adsorbed anions will decrease the amount of dye taken up. In a similar way, the addition of a strongly adsorbed cation will cause an increase in the amount of an acid dye taken up, other factors remaining constant. In all cases there may be some concurrent adsorption of undissociated dyes. On the basis of this theory it is possible to explain the facts met with in dyeing with acid dyes.

The final effect produced by the addition of any given reagent to a dye bath may be the resultant of several different factors. In general, the added reagent may affect either the fiber or the dye bath. It may act on the fiber chemically as in the case of sodium hydroxide on wool, or it may be adsorbed by the fiber thereby modifying the extent of adsorption of other substances.

The effect on the dye bath may be more complex. The dye may be decomposed chemically by the formation of a salt or by the production of the free color acid or base. If the dye is in true solution, the reagent may change its solubility, thereby affecting the amount of dye adsorbed. If the dye is in suspension, the added reagent will produce some change in its degree of dispersion and will therefore influence the amount of dye adsorbed. This latter action is of prime importance in the case of substantive dyes. Finally, the added reagent may change the hydrogen ion concentration of the dye bath. It will be shown subsequently in this paper that the hydrogen ion concentration of the dye bath is the most important single factor affecting the process of dyeing.

In the experiments described in this paper no evidence of any chemical action of the reagents on the fiber was obtained, except with relatively high concentrations of sodium hydroxide. Experiments on the diffusion of the acid dyes employed in this work showed these dyes to be presumably in true solution, at least in neutral, weakly acid, or weakly alkaline baths. Electrometric titration of Orange II indicated that the free acid of the latter is strongly ionized and the other acid dyes used are presumably similar in this respect since they are all sodium salts of sulphonic acid derivatives. It was therefore concluded that in all baths containing acid dyes, with the exception of certain special cases to be noted later, the color was present in solution almost entirely in the form of dye anions. With the basic dyes investigated, however, the evidence obtained from experiments on diffusion showed that these dyes, while in true solution in a neutral dye bath, became increasingly colloidal on the addition of sodium hydroxide, even in relatively small amounts.

The hydrogen ion concentration of the dye bath is probably the most important variable as emphasized previously; but, so far as we are aware, no former investigator has controlled this factor quantitatively, although

Pelet-Jolivet[4] pointed out its importance. Many of the assistants or restrainers, used in dyeing, produce an appreciable and often a great change in the hydrogen ion concentration of the dye bath and their action in many cases is due more to this change than to any other specific action.

The colloidal or adsorption theory agrees well with the facts of dyeing but much of the earlier work on which the theory was based was not quantitative and uncontrolled variables were often present. It therefore seemed advisable to carry out a more rigid investigation, controlling, so far as possible, all the variables involved, but particularly the hydrogen ion concentration of the dye bath. This paper deals with the results obtained with acid and basic dyes.

Experimental

Materials Used.—Two separate lots of wool (Fleisher's knitting worsted) purchased at different times, were used and found to give closely agreeing results. The yarn was first treated with a warm, dilute solution of Ivory soap and was then rinsed thoroughly in tap water followed by many changes of hot distilled water. The air-dried yarn was kept in a large bell jar above a saturated solution of calcium chloride to keep the humidity constant, since Wright[5] has shown that changes in humidity cause an appreciable variation in the moisture content of wool. A small piece of yarn was also kept under the bell jar to serve as a control and was weighed from time to time to detect any such change. No appreciable variation was observed over a period of several months.

In making preliminary experiments to determine the time required for equilibrium to be established between wool and dye bath, it was discovered that the amount of Crystal Ponceau taken up from a neutral bath passed through a maximum as the length of the boiling period was increased, as shown in Table I.

TABLE I

Boiling period in minutes..	45	60	75	90
Milligrams of dye adsorbed	9.6	17.5	15.6	12.7

This unexpected result was finally traced to the presence in the wool of small amounts of soap apparently retained from the previous washing. It is probable that long-continued boiling brought about hydrolysis of this soap and that the fatty acid thus formed was carried by steam to the lower portions of the return condenser where it solidified, leaving the solution slightly more alkaline. Since Crystal Ponceau is adsorbed by the wool less readily from an alkaline solution than it is from a neutral or acid one, a portion of the dye already adsorbed was removed as the bath became alkaline.

All reagents except sodium hydroxide were of the standard grade marked "Chemically Pure." Carbonate-free alkali was prepared by an electrolytic method.[6] The dyes employed in the preliminary experiments were supplied through the courtesy of the National Aniline & Chemical Company. For the later experiments specially purified dyes were made available through the co-operation of E. I. du Pont de Nemours & Co.

Experimental Procedure.—The following procedure was followed throughout this investigation. A dye bath of known composition and of a total volume of 250 cc. was brought to boiling while attached to a return condenser to prevent evaporation. A one-gram sample of the fiber to be tested was placed in this bath and slow but steady boiling was continued for forty-five minutes. In many previous investigations the fiber was allowed to remain in the bath after boiling until the solution had cooled. The latter course is open to serious criticism. Lake[7] has shown that the amount of dye taken up may vary greatly with the temperature of the bath, while it is also certain that equilibrium between the fiber and the solution is reached comparatively slowly at low temperature. If the fiber is allowed to remain in the bath until the solution is cold, the amount of dye adsorbed is probably neither the amount taken up at the boil nor at room temperature, but will be some intermediate value depending on the degree of approach to the room temperature equilibrium. In this work, therefore, the dyed sample was removed directly from the boiling solution at the end of forty-five minutes.

The dye bath was then analyzed for the amount of dye left unadsorbed, the free acid present, or for any other substances as desired. Aliquot volumes were taken for analysis and it was thus unnecessary to correct for the amount of solution retained by the wool.

Determination of the Amount of Dye Adsorbed.—The amount of dye removed by the fiber under given conditions may be determined in two ways. The dyed fiber may be compared with a series of color standards in which the amount of dye is known, or the quantity of dye left behind in the bath is determined. The first method is difficult to apply to the deeper shades and the standards are hard to prepare. The dye left in the bath, however, can be estimated rather easily in the case of certain dye. In the earlier experiments the Kober colorimeter was used for this purpose. As the investigation progressed, however, certain difficulties and possible sources of error in the colorimetric method became evident. The colorimetric analysis of a dye solution is based on the assumption that the intensity of color is proportional to the concentration of dye. On testing this assumption experimentally it was found not to be in strict accord with the facts.[8] For accurate results it is therefore necessary to compare an unknown solution with a color standard of nearly equal concentration. On varying the hydrogen ion concentration of a dye bath, it was observed that acids and bases not only affected the color intensity of the latter, but in many instances also produced a distinct change in the color itself. The following experiments serves to illustrate this effect: 50 cc. of a standard solution of Crystal Ponceau were placed in each of three Erlenmeyer flasks. To one flask 10 cc of water

were added; to the second, 10 cc. of N/10 sulphuric acid, and to the third, 10 cc. of N/10 sodium hydroxide. The solution was then compared colorimetrically. The solution was found to be apparently 8 per cent and the alkaline solution no less than 300 per cent more concentrated than the neutral solution, although the difference of color between the neutral and alkaline solutions rendered exact matching difficult. It is thus evident that color comparisons, at least with this particular dye, must be made between neutral solutions or between those containing the same concentration of acid or base. Salts have but little effect at low concentrations on the color intensity and shade, but in stronger solutions they must also be taken into account. The boiling of wool in the dye bath also renders the bath slightly cloudy and makes exact matching with a clear standard very difficult. Furthermore, the colorimetric method is tedious and the eyes become tired quickly. It was therefore deemed advisable to abandon the colorimetric method and to employ some other means of analysis.

Titration with titanium trichloride, as suggested by Knecht[9] was thereupon tried and was found to give satisfactory results with many dyes. It was found advisable to make a few preliminary experiments with each new dye to determine whether the addition of Rochelle salt was necessary. The titanium chloride reagent was standardized directly in terms of the dye under investigation by titrating a standard solution of the dye to a colorless end-paint. All titrations were carried out in boiling solutions from which air was excluded, in accordance with Knecht's directions.

Determination of Hydrogen Ion Concentration. — Throughout this investigation the hydrogen electrode was used to determine the hydrogen ion concentration of the exhausted dye baths and in some cases also, in the titration of free residual acid. Various types of electrodes and electrode vessels were employed. Free acid was titrated with the Hildebrand[10] electrode. Clark's[11] rocking cell, the Bunker[12] electrode and a simplified form of the device of Lewis, Brighton, and Sebastian[13] were all used in this work at various times for the determination of pH.

The application of the hydrogen electrode proved difficult under the conditions met with in much of this work. Adsorption of dye by the electrode tended to lower the adsorption of hydrogen and to render the electrode inaccurate. Traces of grease on the wool were apparently transferred to the dye baths on boiling and subsequently decreased the activity of the platinum black. Following a suggestion of Dr. E. T. Oakes[14] the activity of the electrodes was restored by immersion in chromic acid cleaning mixture after each determination of pH. Some dyes are reduced by hydrogen in contact with platinum black and this depolarizing action also introduces an error.

It may be mentioned here that an electrode which was known to be giving low readings in a dye solution was found to indicate correct values of pH when used in buffer solutions. It proved to be an easy matter to check buffer solutions; but dye baths presented greater difficulties. The Lewis[15] type of vessel with a partially submerged electrode was found to be most satisfactory. The Bunker[16] electrode gave good results in solutions of inorganic electrolytes, but owing to its smaller surface it was more quickly contaminated than were the larger electrodes of the other types when placed in the dye solutions.

The hydrogen electrodes were supplied with electrolytic hydrogen from a tank. Immediately before use the gas was passed through a quartz tube containing a heated nichrome spiral, to make certain of the complete removal of oxygen.

Normal and saturated calomel electrodes were used as standards and were frequently checked for accuracy. Potentials were measured at room temperature to the nearest millivolt by means of a Leeds and Northrup "student type" potentiometer. In view of the sources of error met with in determining the pH of dye baths, as discussed in the previous paragraphs, the use of a potentiometer of extreme precision was not deemed worth while.

Adsorption of Hydrochloric Acid by Wool.—The adsorption of acids by wool has been studied previously by several investigators.[17] Since the amount of acid taken up varies with the specimen of wool, and as the experimental conditions used by previous workers did not correspond entirely with those under which the present experiments on dyeing were to be carried out, it seemed advisable to redetermine the adsorption isotherm for hydrochloric acid and wool.

One-gram portions of the yarn were placed in boiling solutions of hydrochloric acid of known concentrations, all the solutions having a volume of 250 cc. After boiling for forty-five minutes (tests had shown this time to be sufficient for the establishment of equilibrium), the yarn was removed and 100 cc. portions of the cooled solutions were titrated to determine the amount of unadsorbed acid. The data are given in Table II.

TABLE II

ADSORPTION OF HYDROCHLORIC ACID BY WOOL

cc. N/10 HCl at Start	cc. N/10 HCl at End	cc. N/10 HCl Adsorbed
1.00	0.87	0.13
2.00	1.77	0.23
3.00	2.60	0.40
5.00	4.28	0.72
7.00	6.05	0.95
10.00	8.47	1.53
15.00	13.05	1.95
25.00	22.30	2.70

The isotherm (*Fig.* 1) drawn from the data in Table II is more suggestive of solid solution following Henry's law than of adsorption, but when it is considered that the highest concentration of acid remaining behind in the

bath amounted only to about one-hundredth normal, it is seen that the curve, as drawn, really constitutes the first portion of the complete adsorption isotherm and is, therefore, practically a straight line over the small shown. Georgievics and Pollak[18] have shown conclusively that the taking up of acids by wool is strictly an adsorption phenomenon.

Experiments were next performed to determine the adsorption of acid from a bath containing both acid and dye to see whether the adsorption of acid by wool is affected by the simultaneous adsorption of dye. Fort and Swares and Fort and Andersen[19] have taken up this question and they present data to show that when both dye and acid are present in a bath, less acid is taken up by the wool than when acid alone is present. There is apparently, therefore, a displacement of acid by the dye.

One-gram portions of wool were treated as previously described in boiling dye baths containing hydrochloric acid and Crystal Ponceau. The amounts of dye and free acid left in the bath were determined respectively with the colorimeter and the hydrogen electrode. In all cases

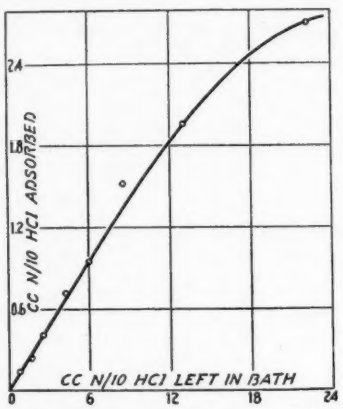


FIG. 1—*Adsorption of Hydrochloric Acid by Wool*

the weight of dye at the start was seventy-five milligrams; the acid content was varied as stated in Table III; and the total volume of the bath was maintained at 250 cc. Larger quantities of acid were not used because at the highest concentration given, practically all of the dye was taken up by the wool. The values given are the averages of duplicate determination.

TABLE III

ADSORPTION OF HYDROCHLORIC ACID IN THE PRESENCE OF CRYSTAL PONCEAU

cc. N/10 HCl at Start	Final pH of Bath	cc. N/10 Acid Left	cc. N/10 Acid Removed	Mgs. Dye Adsorbed
0.00	5.30	....	....	4.5
1.00	5.10	0.15	0.85	34.9
2.00	4.20	0.47	1.53	56.3
3.00	3.60	1.20	1.80	67.9
5.00	3.00	2.93	2.07	73.4
7.00	2.75	4.65	2.25	74.2

If one compares these data or the corresponding isotherm (*Fig.* 2) with the previous data and isotherm (*Fig.* 1), it is at once apparent that much more hydrochloric acid has disappeared from the bath containing acid and dye than was the case with the bath containing acid alone. It does not necessarily follow, however, that this increase represents a greater adsorption of hydrochloric acid. Crystal Ponceau has the formula $C_{10}H_7N:NC_{10}H_4OH(SO_3Na)_2$ and contains 9.16 per cent sodium. It is probable that the dye, being a sodium salt, is largely dissociated in aqueous solution. In these acidified dye baths we probably have hydrogen ions strongly adsorbed by the wool. In order that the fiber shall remain electrically neutral there must be an adsorption of some anion, in this case, the dye anion. As a result, sodium ions remain in the bath, together with the anions from the mineral acid, the adsorption process resulting in a replacement of the free mineral acid with its sodium salt. The dis-

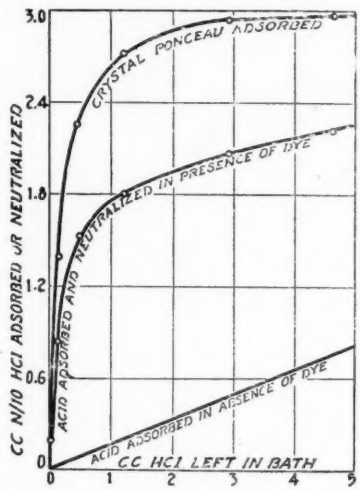


FIG 2—*Adsorption of Hydrochloric Acid and Crystal Ponceau by Wool (¼ the ordinates gives milligrams Crystal Ponceau adsorbed)*

appearance of hydrochloric acid in the above experiment may therefore be due, not to increased adsorption of the acid, but to its neutralization. If hydrochloric acid has been neutralized, all the chloride ions will be left in the bath while adsorption of the acid will remove chloride ions. The following experiments were performed to answer this question:

Two dye baths were prepared containing 108.5 milligrams of Crystal Ponceau and 7 cc. of N/10 hydrochloric acid in a total volume of 267 cc. One-gram samples of wool were boiled in each bath for forty-five minutes and then removed. The resulting solutions were analyzed for unadsorbed dye, for free acid, and for chlorides. Chlorides were determined by decolorizing the solutions with electrolytic hydrogen and then titrating with N/10 silver nitrate using potassium chromate as an indicator. The results are given in Table IV.

(*Continued on page* 461.)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

President
LOUIS A. OLNEY
Lowell Textile School, Lowell, Mass.

Vice-Presidents
WILLIAM D. LIVERMORE WILLIAM H. CADY

Secretary
WALTER E. HADLEY
5 Mountain Avenue, Maplewood, N. J.

Treasurer
WINTHROP C. DURFEE
516 Atlantic Avenue, Boston, Mass

Councilors
ELMER C. BERTOLET GEORGE A. MORAN
ARTHUR E. HIRST WILLIAM K. ROBBINS
WALTER M. SCOTT

LOCAL SECTIONS AND THEIR OFFICERS

Northern New England Section—
Hugh Christison, Chairman, Arlington Mills, Lawrence, Mass.
A. K. Johnson, Secretary, Lowell Textile School, Lowell, Mass.

Rhode Island Section—
Ralph F. Culver, Chairman, Box 269, Providence, R. I.
Leslie L. Bamberger, Secretary, U. S. Finishing Company, Providence, R. I.

New York Section—
P. I. Wood, Chairman, Oriental Silk Printing Company, Haledon, N. J.
L. C. Lewis, Secretary, 95 Madison Avenue, New York City.

Philadelphia Section—
Robert E. Rose, Chairman, E. I. du Pont de Nemours & Co., Wilmington, Del
Elmert C. Bertolet, Secretary, Philadelphia Textile School, Philadelphia, Pa

REPORT OF ANNUAL MEETING DELAYED

IT had been expected that it would be possible to begin the publication in this issue of a verbatim account of the Annual Meeting of the American Association of Textile Chemists and Colorists. As a matter of fact, the transcription of the stenographic record has occupied so much time that this has been impossible. It was felt that the records of all important remarks ought to be referred to their authors before publication, and this work has occupied so much time that it will be impossible to begin the publication of the detailed proceedings before the issue of January 1, 1923.

NINTH RESEARCH COMMITTEE MEETING

The ninth meeting of the Research Committee of the American Association of Textile Chemists and Colorists was held at the Engineers' Club, Boston, Mass., Friday afternoon, November 10, 1922.

The following members were in attendance: L. A. Olney, William D. Livermore, William H. Cady, Winthrop C. Durfee, George A. Moran, William K. Robbins, W. M. Scott, W. J. Murray, E. H. Killheffer, R. F. Culver, H. Christison, W. E. Hadley, A. E. Hirst.

The special committee which was appointed at the June meeting to consider the Fastness of Dyed Materials to Light, of which William H. Cady is Chairman, presented a very complete outline of the work which has been accomplished to date relative to this subject, including an extremely complete review of the literature. The paper as presented will shortly appear in full in the Proceedings. In the meantime, the work of the committee will be continued, the personnel of same having been augmented by the following members, who were appointed by the President: William H. Cady, Chairman; Dr. W. M. Scott, H. Christison, George A. Moran, A. E. Hirst, A. K. Johnson, E. H. Killheffer, R. F Culver, Dr R. E. Rose, Dr. W. J. Murray, William D. Livermore, William K. Robbins, W. E. Hadley.

The sub-committee investigating the Fastness of Dyed Material to Bleaching, reported excellent progress, and the subject was discussed at considerable length. A. E. Hirst, Chairman of this committee, presented a large number of samples of prints which had been subjected to the action of chlorine and the results of these trials are being compiled in such a manner that it will soon be possible to formulate a series of standards relative to fastness to bleaching.

Very respectfully submitted,

W. E. HADLEY, Secretary.

DECEMBER MEETING OF RHODE ISLAND SECTION

The regular December meeting of the Rhode Island Section of the American Association of Textile Chemists and Colorists will be held jointly with the Rhode Island Section of the American Chemical Society at the rooms of the Providence Engineering Society, 42 Washington Street, Providence, R. I., on Friday, December 22 at 8 p. m.

The speaker will be A. N. Dana, B.A., Yale, of the Franklin Process Company and Franklin Process, Ltd., who will talk on Some of the Very Apparent Advantages of Dyeing in the Wound Form. Mr. Dana

will show many examples of actual work and will exhibit a small working model of the Franklin machine. As this is a subject which will interest all textile men, we expect to have a large percentage of our membership to represent the society at this joint meeting.

The meeting will be preceded by an informal dinner at the Rathskeller at 6.30 p. m. All members desiring to attend the dinner will please notify the secretary as promptly as possible. The cost of the dinner will be $1.25 a plate.

L. L. BAMBERGER, Secretary,
The U. S. Finishing Company,
389 Charles Street,
Providence, R. I.

DECEMBER MEETING OF NEW YORK SECTION

The December meeting of the New York Section of the Association will be held at the Hotel Pennsylvania, Friday, December 22, at 8 p. m. Members from other sections visiting New York at this time are invited to be present.

The meeting will be addressed by Victor Wichum, of the C. J. Tagliabue Manufacturing Company, on the subject of Time-Temperature Control of Dyeing and Similar Operations, and an open discussion of the subject will ensue. Mr. Wichum has considerable data showing the importance of time-temperature control apparatus to successful and economical dyeing operations and, as this is a subject of interest to all, a large attendance is expected.

L. C. LEWIS, Secretary.

CHANGES IN ADDRESSES OF MEMBERS

The following changes in the addresses of members should be noted:

Alpers, George H., 9124 Ninety-first Street, Woodhaven, N. Y.
Bannon, Francis E., Du Pont, 8 Thomas Street, New York City.
Bartenbach, Oscar C., 6201 Broadway, New York City.
Cady, William H., Chemical Department, Pacific Mills, Lawrence, Mass.
Caya, Ferdinand, 415 Franklin Street, Buffalo, N. Y.
Church, Charles H., Glenylon Print Works, Phillipsdale, R. I.
Colonel, J. P., 6114 Broadway, Cleveland, Ohio.
Creaser, J. H., 129 Nelson Street, Providence, R. I.
Cushing, Frederic C., Stottville, N. Y.
Daigneault, H. J., 28 North Main Street, Providence, R. I.
Dean, Robert J., 606 Prospect Street, Fall River, Mass.
Friedman, Louis, 5529 Jackson Street, Pittsburgh, Pa.
Garnett, S. I., 57 Arnold Avenue, Providence, R. I.
Hacking, James H., 44 Melrose Avenue, Pawtucket, R. I.
Jones, A. S., 36 Beacon Street, North Adams, Mass.
Kidd, Thomas E., P. O. Box 142, Central Village, Conn.
Lewis, L. C., 95 Madison Avenue, New York City.
Linberg, George O., Box 1201, Springfield, Mass.
Lommell, George C., Madison Avenue, Bergenfield, N. J.
Lyons, Robert K., 159 Lloyd Avenue, Providence, R. I.
Mace, C. A., 660 South Seventh Avenue, Mount Vernon, N. Y.
Millspaugh, E. S., Real Estate Trust Building, Atlantic Dyestuff Company, Philadelphia, Pa.
Nuttall, Fred L., 2504 West Silver Street, Philadelphia, Pa.
Perlman, S. Donald, 84 Prospect Street, Passaic, N. J.
Poetzsch, Otto T., 158 Gregory Avenue, Passaic, N. J.
Prescott, W. F., 14 St. Sacrament Street, Montreal, Quebec.
Russell, Joseph W., Palmer Mill, Three Rivers, Mass.
Shreve, R. Norris, 74 South Munn Avenue, East Orange, N. J.
Southwick, C. H., 335 South Main Street, Woonsocket, R. I.
Thompson, H. J., 15 Greenleaf Street, Malden (48), Mass.
Washburn, M. J., 66 Pine Street, Lowell, Mass.
Worthen, Clifford T., East Wareham, Mass.
Zillessen, Ernest A., 162 Grant Avenue, Nutley, N. J.

NAME WITHDRAWN FROM MEMBERSHIP

A. M. Burt, Rocky Mount Hosiery, Rocky Mount, N. C.

NOTICE FROM SECRETARY

Applications for Membership in the American Association of Textile Chemists and Colorists

All individuals who believe that they are eligible for membership in the American Association of Textile Chemists and Colorists and are desirous of affiliating themselves with the organization, can communicate with the Secretary, who will gladly furnish application blanks and extend to them every possible assistance.

It is desirable that members of the Association should make an effort to interest all those who they believe would make desirable members.

The Secretary will, at all times, be pleased to provide members with as many application blanks as may be desired.

W. E. HADLEY, Secretary.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
Advisory Editor

LAURANCE T. CLARK
Managing Editor

Published biweekly by

HOWES PUBLISHING CO., INC.
4109 Woolworth Building, New York City

A. P. HOWES, *President* E. S. PREDMORE, *Secretary*

Subscription price $5.00 per year; Canadian $5.50; foreign $6.00.

Vol. XI December 18, 1922 No. 13

THE INDEX TO VOLUME XI, THE INDEX TO A. A. T. C. C. PROCEEDINGS—AND AN ANNOUNCEMENT

WITH this issue, which concludes its eleventh volume, The REPORTER publishes an index to the contents of the past thirteen issues, including the present one. The index occupies four pages in the center of this issue, but can readily be detached and placed at the end by those who bind their volumes.

Every care has been taken to make this index accurate and convenient. Each technical article, irrespective of the subject or subjects involved in the title, has first been listed according to the initial letter of that title, excepting only those which begin with the words "the" or "a"—in which instances the first word following has been used as the "key." The article is then listed by subject or subjects, and in cases where the article is in several parts, whether or not these parts appeared in consecutive issues, the same procedure has been followed excepting that the page numbers of parts are given but once, under the initial "key word" listing, while subject references refer the reader to this "key" word for the complete index of parts. In the Subject Index, the name of the author, in parentheses, follows each title; in the Author Index collaborators are listed separately, with the complete index of parts of articles following each name.

An example which is typical is the article, A Consideration of the Various Substances Used in the Construction of Dyeing and Bleaching Utensils and Apparatus, by Grandage and Hadley. This appeared in three parts, and in the Subject Index it is first listed under Consideration, discarding the A. Under this heading will be found the page numbers to Parts I, II and III. The article is then listed under Apparatus, Dyeing, and Bleaching, followed by the words, "See under Consideration." In the Author Index a complete index to the three parts will be found under both Grandage, H—, and Hadley, W. E.—.

Subjects which come under group headings, such as Editorials, are listed but once, under their respective groups. Proceedings of the American Association of Textile Chemists and Colorists, as heretofore, appear under Proceedings, while technical papers of this organization appear separately classified as other articles, with references to REPORTER page numbers.

For the convenience of members, there has been published a separate Index to the Proceedings of the A. A. T. C. C. This follows immediately after the Reporter index, and the page numbers refer to the regular consecutive Proceedings page numbers at the *bottom* of each page. This index occupies pages 99 and 100 of the Proceedings in this issue (or pages 457 and 458, REPORTER page numbers), and will automatically take its place at the end of the complete Proceedings when these are taken out and bound together by members.

The scheme of the Proceedings Index is somewhat different from that of the REPORTER Index in that, being shorter, it is less elaborate. However, it will be found adequate, and, we believe, accurate. The activities of the various Sections, from their inaugural meetings to date, will be found under the titles of the Sections themselves, while activities of the Association proper are placed under that heading. Technical papers are grouped together, as well as authors, thereby providing a suitable cross-index. Abstracts are listed under another heading, but the names of the authors whose works are abstracted are not included separately in the general list. The activities of such official bodies as the Council and the Research Committee are likewise grouped under their proper headings, and are listed chronologically.

With this issue, The REPORTER announces a change of policy involving the number of issues to a volume. The practice has been to run thirteen issues—covering six months—to a volume. During 1923, however, and thereafter, the full twenty-six issues will make up a complete volume, the index appearing in the final issue for the year.

A USEFUL ORGANIZATION ARRIVES

THE Chemical Equipment Association, comprising manufacturers of equipment essential to the score or more of chemically controlled industries of the continent, has established national executive offices at 1328 Broadway, New York City. This move represents the successful culmination of a project launched some time ago. The Association was organized this fall and we are glad to note that it is now ready for business.

It has begun active work through a national membership for the fostering of trade in chemical equipment, for the improvement of practices in the production and distribution of such equipment, and in the

performing of engineering services incidental thereto.

Not only does its activity signalize the adoption of trade association methods by the companies constituting the equipment base of the nationally vital chemical industries, but it represents a movement toward manufacturing and distributing co-operation in these same strategic points which has attracted the attention of Secretary of Commerce Hoover, who personally encouraged the organization of the Association, and which has elicited such comment as this from an officer of the Chamber of Commerce of the United States:

"Such supply company organizations as the Railway Equipment Association, the Motor and Accessory Manufacturers' Association, the Association of Ice Cream Supply Men, the recently formed Chemical Equipment Association, and other groups representing the supply and equipment ends of leading industries, the members of which are manufacturers of miscellaneous commodities, but connected with a specific industry, for market expansion, educational work, publicity, research, credit protection, and prevention of trade abuses, is one of the most interesting current trade association trends."

The Chemical Equipment Association was organized September 12, 1922, following preliminary activities of an organization committee of representatives of leading manufacturers.

The officers of the Association are: President, Pierce D. Schenck, president the Duriron Company, Inc., Dayton, Ohio; vice-presidents, J. George Lehman, vice-president and general manager Bethlehem Foundry & Machine Company, Bethlehem, Pa.; Walter E. Lummus, president the Walter E. Lummus Company, Boston, Mass.; Adolph Coors, Jr., vice-president Coors Porcelain Company, Golden, Col.; treasurer, Percy C. Kingsbury, chief engineer General Ceramics Company, 50 Church Street, New York City; Secretary, Robert Everett.

The directors are: H. N. Spicer, the Door Company, New York City; P. S. Barnes, the Pfaudler Company, New York City; Edwin C. Alford, T. Shriver & Co., Harrison, N. J.; T. C. Oliver, treasurer-general manager Chemical Construction Company, New York City; Hamilton Allport, E. B. Badger & Sons Co., New York City.

The Association has already established communication with nearly 200 of the large industrial associations of the country, announcing itself as a source of information in chemical equipment supply matters, and it has begun a regular bulletin service to members. The Association is, further, arranging details of a permanent co-operation with the Department of Commerce in the collection and dissemination of vital trade information.

This Association is the fourth organization in the chemical industry. The Synthetic Organic Chemical Manufacturers, the Manufacturing Chemists and the Scientific Instrument Makers already have organizations. The Chemical Equipment Association is an organization of manufacturers of chemical process equipment.

One of the chief difficulties that have been encountered in the past concerns the matter of technical service in installing equipment in plants. For example, when a purchaser orders equipment from a manufacturer it is usually necessary for a technical man to go to the plant to properly install the new equipment, and also to give instruction in the care and operation of such equipment. There has been in the past confusion as to the proper method of charging for such service. The new organization will standardize equitable charges in such cases.

An equal degree of difficulty has frequently arisen over the resale of chemical process equipment manufactured for specific purposes. The handling of second-hand machinery of this character has in many cases fallen to men who know nothing about the manufacturing of chemical equipment. Now, through the Association, the heavy equipment manufacturers will endeavor to protect themselves and their customers by determining some new and better method of handling such second-hand materials.

This move of the equipment manufacturers to organize and eliminate duplications in trade nomenclature and the thousand and one other exasperating and time-wasting conditions arising from go-as-you-please, individualistic manufacturing and marketing, is in line with the general trend of the past year or so in our chemical industries, and is to be heartily welcomed as one more step in the direction of eventual unity and independence.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

N. M.—*Question:* What are the chief difficulties in the practical dyeing of artificial silk (viscose) and how are they most easily overcome?

Answer: There should be no especial difficulty in dyeing viscose artificial silk if you follow the general rules carefully. First, remember that the very act of wetting the fiber reduces its tensile strength to a mere

fraction of its strength when dry. Therefore it must be handled with care at all times and not worked too much in the dye bath. Second, avoid the action of boiling water, either neutral or containing alkalies or acids, as the luster and strength will both suffer. Third, select dyestuffs which will exhaust well at low temperatures and yet not go on so rapidly that much working of the skeins is necessary. Fourth, after rinsing and whizzing and while the material is still damp, straighten, stretch and dress up the skeins so that the bands and ties do not restrict the straight lie of the threads, as any kink or bend whhich dries into artificial silk always remains a kink, and rapid winding is almost impossible. These rules apply to all classes of colors. We have seen direct, developed, sulphur, and vat dyes dyed on viscose artificial silk without loss of strength or luster by merely observing these rules. On the other hand, many lots have been ruined with ordinary direct dyes by not paying attention to these simple details.

J. W. G.—*Question:* What dyestuff may be used to color buttons made of vegetable ivory? How can I get fast colors?

Answer: Since vegetable ivory is a lignified cellulose it may be colored with direct, acid, basic, and sulphur dyes. In all cases the made-up buttons are boiled for an hour or two with a strong dye solution and salt. In the case of sulphur dyes it is necessary to use sodium sulphide and also to avoid the use of copper, brass, aluminum, or any other metal kettles except iron and Monel metal. None of these classes of dyes will give more than surface penetration, and fastness is obtained by the use of such direct or sulphur dyes as are fast to light. When penetration is required the dye is dissolved in denatured alcohol, water and aniline oil, basic dyes being most suitable, and the buttons allowed to remain in the color solution, even for days, till penetrated.

E. B. H.—*Question:* I am desirous of coloring a mixture of white inert powders with a delicate pink tone. I wish to do this while mixing a 500-pound lot a drum mixer. What is the best procedure?

Answer: Probably the best coloring matter for you to use is Rhodamine B Extra. Be sure to buy only the concentrated type or it will not be entirely soluble in alcohol. Dissolve one ounce of the dye in a pint of denatured alcohol and simply sprinkle it over the material you are going to mix. The mixing will distribute the color evenly and no specks will result. In case the odor of denatured alcohol is in any way objectionable, there is a grade of highely refined methyl or wood alcohol which is practically odorless.

I. L. H.—*Question:* What is the action of boiled-off liquor or gum soap in the dyeing of silk?

Answer: While the use of boil-off liquor was introduced at first simply because it had been observed to promote even dyeing and resulted in more lustrous and brilliant colors, there is an excellent reason for its use. Natural silk consists of two parallel fibers coated and cemented together by a material known as gum. Silk gum differs little in its chemical nature from silk itself, the main difference being its solubility in weak alkaline solutions. The boil-off removes this gum from the silk without injuring the silk fibers (providing it is not too alkaline nor continued too long). Gum soap therefore contains soap, the dissolved gum of the silk, and an emulsion of the oils used by the throwster. Its chemical properties are those of an alkali (soap) and it has in addition the physical properties due to an emulsified oil and a soluble colloid. The addition of any acid in small amount decomposes first the soap and liberates free fat acids which react with the remainder of the soap to form superacid soaps—no trace of the mineral, or organic, acids which were used for breaking the bath remain. Also note that it matters little what acid is used, only the quantity, as the soap neutralizes it, providing an excess is not used. The silk gum is not precipitated and is never absorbed by the fiber.

Silk, chemically speaking, is an amido acid and amphoteric; i. e., is capable of uniting with either an acid or a base. Silk requires to be acidified (soured) before it will take up any considerable amount of dyestuff, but if the stronger acids are used the dye will be taken up with too great rapidity, and unevenness will result, together with a tendency of the fiber to become tender after a short time. By dyeing in a broken soap bath the only acidity imparted to the silk is that of the fat acids of the superacid soap, hence the absorption of dye is less rapid. Furthermore, the presence of the soluble gum acts as a protective colloid and favors the union of dye and fiber in a manner that gives the greatest amount of tinctorial effect with a minimum of action on the fiber itself.

In cases where gum soap is not available dyers have successfully used ordinary glue or gelatine dissolved in hot soap solution. This reminds us to recall to your attention that the addition of glue to a sulphur dye bath not only protects silk from the action of the strongly caustic sulphide but also prevents it from taking any color out of the bath.

THE PHYSICAL CHEMISTRY OF DYEING

(*Continued from page* 450.)

The data from these two trials indicate that the actual adsorption of hydrochloric acid has been practically unaffected by the presence of the dye (compare (c) and (h)) while most of the disappearance of the free acid was due to its neutralization. The amount of hydrochloric acid actually neutralized was almost exactly one-half of the calculated maximum, pointing to an adsorption of the dye as an acid or primary sodium salt. This explanation becomes more probable if it is remembered that the sulphonic acid groups in the dye are in such a

TABLE IV

ADSORPTION OF DYE AND ACID FROM THE SAME BATH

	I	II
(a) cc. N/10 HCl at start.....	7.00	7.00
(b) Total N/10 chlorides left in bath..	6.31	6.47
(c) HCl adsorbed (a — b).....	0.69	0.53
(d) cc. free acid left in bath.....	4.26	4.39
(e) HCl neutralized by sodium in dye (b — d)	2.05	2.08
(f) Milligrams of dye adsorbed.....	104.80	104.60
(g) Calculated possible HCl neutralized by dye	4.17	4.17
(h) Adsorption of HCl from solution without dye (*Fig.* 1).....	0.65	0.67

position that one of them acts as a much stronger acid group than the other.

To determine whether other dyes behaved in a similar manner, experiments were performed in which Croceine Orange replaced Crystal Ponceau. In dyeing, the same procedure was followed, the dye bath containing seventy-five milligrams of the dye and a known amount of hydrochloric acid in a total volume of 250 cc. One-gram portions of wool were placed in the boiling dye baths for forty-five minutes. Unadsorbed dye was determined colorimetrically. Free acid was estimated by titration with the hydrogen electrode and total chlorides were determined electrometrically. Croceine Orange cannot be readily decolorized with hydrogen, so it became necessary to employ a volumetric method for the determination of chlorides in colored solutions. This problem was solved by the use of a silver electrode.[20] The average of duplicate experiments with Croceine Orange are given in Table V. They have been plotted in *Fig.* 4.

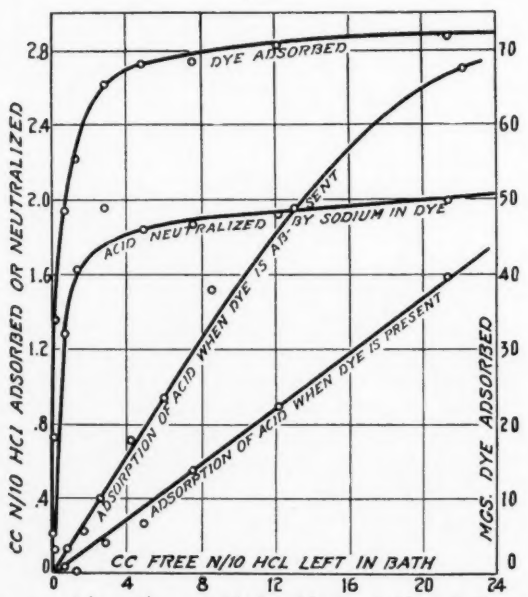


FIG. 4—*Adsorption of Hydrochloric Acid and Croceine Orange by Wool*

TABLE V

ADSORPTION OF CROCEINE ORANGE AND HYDROCHLORIC ACID FROM THE SAME BATH

cc. N/10 HCl at Start	cc. N/10 HCl at End	cc. N/10 Cl' at End	Mg. Dye Adsorbed	pH
0.00	....	....	5.1	6.8
1.00	0.13	0.87	33.8	5.0
2.00	0.68	1.96	48.5	3.8
3.00	1.36	2.99	55.4	3.3
5.00	2.89	4.88	65.5	2.9
7.00	4.88	6.73	68.2	2.6
10.00	7.57	9.44	68.5	2.4
15.00	12.18	14.11	70.7	2.2
25.00	21.44	23.43	71.8	2.0

cc. N/10 HCl at Start	cc. N/10 HCl Adsorbed	cc. N/10 HCl Found	Neutralized Calc.	pH
1.00	0.13	0.74	0.96	5.0
2.00	0.04	1.28	1.38	3.8
3.00	0.01	1.63	1.58	3.3
5.00	0.16	1.95	1.87	2.9
7.00	0.27	1.85	1.94	2.6
10.00	0.56	1.87	1.96	2.4
15.00	0.89	1.93	2.02	2.2
25.00	1.57	1.99	2.05	2.0

(*To be continued.*)

"The Physical Chemistry of Dyeing" References, Part I

[1] Jour. Phys. Chem., **18,** 1, 118, 385 (1914); **19,** 50, 145 (1915).
[2] An acid dye is one which contains the color in the acid radical and which dissociates in water solution to give colored anions.
[3] Bancroft: Jour. Phys. Chem., **18,** 10 (1914); "Applied Colloid Chemistry," 115 (1921).
[4] Rev. gén. mat. color., **12,** 97 (1908); Abstracts, **2,** 2159 (1908).
[5] Jour. Soc. Chem. Ind., **28,** 1020 (1909).
[6] Jorissen and Filippo: Zeit. angew. Chem., **23,** 726 (1910).
[7] Jour. Phys. Chem., **20,** 761 (1916).
[8] Compare Gordon: Color Trade Jour., **6,** 61 (1920); Chem. Abstracts, **14,** 2420 (1920)
[9] Ber. deutsch. chem. Ges., **36,** 1552 (1903); **40,** 3819 (1907).
[10] Jour. Am. Chem. Soc., **35,** 387 (1913).
[11] Jour. Biol. Chem., **23,** 475 (1915).
[12] Ibid., **41,** 11 (1920)
[13] Jour. Am. Chem. Soc., **39,** 2250 (1917).
[14] Personal communication to the author.
[15] Jour. Am. Chem. Soc., **39,** 2250 (1917)
[16] Jour. Biol. Chem., **41,** 11 (1920).
[17] Georgievics and Pollak: Monatsheft., **32,** 655 (1911); Mills and Takamine: Jour. Chem. Soc., **43,** 142 (1883)
[18] Monatsheft, **32,** 655 (1911)
[19] Jour. Soc. Dyers and Colorists, **31,** 80, 96 (1916).

CLASSIFIED

FOR SALE

Methyl Violet Base, 1,000 lbs., 75c. per lb. Spirit Nigrosine, Blue Shade, 1,400 lbs., 35c. per lb. Both in stock, New York. Address Box 216, care of the American Dyestuff Reporter, 4109 Woolworth Building, New York City

HOSIERY DYEING

(*Concluded from page 446.*)

Tussah silk. In dyeing artificial silk and cotton it is necessary to favor the cotton as much as possible. This is done by using an excess of dyestuff and running at a low temperature. Artificial silk, as well as Tussah, combined with other fibers is used for decorative purposes and the process includes much the same manipulation as outlined for two tones above; viz., the production of a ground shade on one fiber, leaving the other unstained so it may later be dyed a contrasting color. As artificial silk takes dyestuff very readily a special selection of wool or silk colors must be made, using dyestuffs with no affinity for the vegetable fiber.

RESUME

PROPER MACHINERY, SPACE, KNOWLEDGE OF DYESTUFFS, WATER, STOCK, ETC.

The hosiery dyer of to-day must have knowledge of practically all textile materials and of the suitable dyestuffs. He uses many types of machinery and is called upon for results, the production of which will tax his ingenuity. He must keep constantly informed of new methods and new products and he is justified in expecting the fullest co-operation from the manufacturer in order that he may have proper space, equipment, and material to solve the problems with which he is confronted.

Bleaching and Dyeing Tussah Silk

Removing the Bast—Bleaching—The Hydrogen Peroxide Bath—The Sodium Peroxide Bath—Dyeing—The Basic Dyes—Weighting and Dyeing Black—Brightening—Method of Preparation

BY GEORGE EMMONS

THERE have been as many as five or six wild silks discovered and brought to the attention of the commercial world. But of these Tussah silk is apparently the only one which has secured a real place among the textile fibers.

Ailanthus silk, Ricinus silk, Fagara silk and oak silk (including the Chinese Tussah silk) are other varieties of wild silk. This is a more or less complete list of the silks other than the Tussah silk of India and Bengal.

Tussah silk comes into the market in two forms—hanks and tissue. It is sometimes known as bast silk. This fiber is of considerable importance. It differs from mulberry silk in certain particulars. And the scouring, bleaching, loading and dyeing are carried on by processes which are somewhat modified from those employed in treating ordinary silk.

The cocoons of Tussah silk are said to be four times the size of those made up of mulberry silk and to be much harder. That is to say, a representative Tussah cocoon will measure from 1.6 to 1.8 inches in length and from 1 to 1.2 inches in width. The filament, like that of ordinary silk, is a double affair. It will have a length of about 460 feet. The weight of this long double filament will be from two to three grams.

In the cocoon, the filament is cemented together by a binding material consisting almost entirely of sodium urate. If the cocoon is suitably impregnated with an alkaline liquid, the cement will be dissolved. The filament may then be easily unwound.

The weight of silk fiber obtained from a single cocoon will be around 0.6 to 0.9 gram. The diameter is not far from double that of mulberry silk. It is said to average 0.045 by 0.024 millimeter (0.0180 by 0.0096 inch).

Where the filament of Tussah silk crosses itself in the cocoon, it is more or less flattened. This is a point of distinction from mulberry silk. Moreover, the cross-section of the filament is flatter, so that it has a ribbonlike form. The cocoons are treated in the East or are shipped abroad in the untreated state. The Eastern treatment is not always satisfactory—hence the exportation of the cocoons.

There is a kind of Tussah Schappe, which is spun from the waste of the cocoons. This material is usable in the manufacture of plush, imitation pelt and certain fancy fabrics. The filament of Tussah silk is provided with air ducts and possesses a distinct longitudinal striation. When scoured, it has a higher and a more vitreous luster than mulberry silk. Instead of the yellow to white shades disclosed by mulberry silk, Tussah silk appears brown to grayish brown. From a chemical point of view also, Tussah silk may be distinguished from the ordinary kind from the fact that it contains no true sericin. The silk consists of a fibroin and the aforementioned cement. This fibroin is different from that of mulberry silk.

The substance known as "bast" and contained in Tussah silk consists of mineral salts, tanning agents, etc., that have been absorbed from the water during the process of reeling. The brown or brownish color of Tussah silk is understood to be due to the presence of this bast.

The content of mineral salts in Tussah silk is greater than is the case with mulberry silk. This is true as respects the raw article and also as respects the fibroin. The behavior of Tussah silk with respect to chemicals may be said to correspond roughly with that of ordinary silk. There are, however, some points to notice. Thus, Tussah silk displays a greater resistance to chemical agents, particularly alkalies. It is difficultly soluble in ammoniacal copper oxide and zinc chloride. The behavior

of Tussah silk towards dyestuffs is by no means the same as that of ordinary silk. After scouring, Tussah silk has a distinctly greater capacity for the absorption of dyestuffs than has mulberry silk. "Many dyestuffs are taken up with great avidity, and the dye baths are sometimes completely exhausted in a few minutes."

The process of reeling results in the absorption from the water of certain vegetable compounds having a capability of tanning. When, later on, the Tussah silk is boiled in water, more or less of this vegetable matter is redissolved. If tested, it will be found that the solution will give a tanning reaction.

Tussah silk discloses a different behavior towards soap. That is to say, the beforementioned bast seems to combine with the soap—"at least, the Tussah becomes more adhesive when treated with soap, and no bast soap is obtained. There are, however, commercial Tussahs which will stand soaping without becoming agglutinant.

It seems inaccurate to speak of the cementlike substance found in Tussah silk as bast. The binding material consists chiefly of sodium urate, a modified tannin, a gelatinous substance and a waxy fat. It does not act as a sheath, but nevertheless binds the whole together. Thus "bast" may be removed by boiling the silk in a liquor consisting of water in which has been dissolved one per cent of its weight of soda crystals or one-half per cent of soda that has been calcined. The bath is not permitted to boil in an active manner, but is kept at or just under the boiling temperature. The operation may last one hour.

The cementing material goes into solution. Moreover, the water absorbs from the fiber more or less of its coloring matter. Consequently, the water turns a dirty brown.

The same bath should not be used for a fresh lot of the silk. If this caution is disregarded, one is to expect that brown coloring matter in solution in the old bath will be absorbed by the fresh fiber, giving it a still darker color. It is understood that fiber thus darkened will require several thorough washings to rid it of its unwanted material.

Instead of the boiling-hot solution of soda, one may substitute a solution of water glass (soluble glass, silicate of soda) containing in addition a small amount of caustic soda.

After the boiling treatment mentioned has come to an end, the silk is treated in a boiling-hot solution of soap. This bath will contain from 10 to 15 per cent of soap. After the fiber has been duly washed it will be ready for bleaching or dyeing, as the case may require.

I add the following: "Of course, the brown-colored bath liquor cannot be used as 'Tussah soap.'" And, "Boiling with diluted caustic soda also gives good results, but does not seem, as yet, to have been very largely employed."

It is not always necessary to give a bleaching treatment. The character of the dyeing will largely control matters. If the brown or grayish brown will be overcome by the shade produced by dyeing, bleaching may be unnecessary.

Where bleaching is to be carried out, the use of the sulphur method will probably be ineffective. The coloring matter that has to be destroyed consists of an oxidized tannin. A rather powerful oxidizing agent appears necessary.

Hydrogen peroxide, sodium peroxide, or perboric acid may be employed.

A suitable bleaching bath may be prepared in accordance with the following recipe:

Hydrogen peroxide (12 per cent, by volume, of H_2O_2)	20- 30 liters
Water glass	800-1,000 grams
White soap	500- 600 grams
Water	100- 120 liters

The white soap is first dissolved in a suitable quantity of water, and then used.

This bath is first used cold, the silk being immersed in it for, say, twelve hours. After this cold treatment, the bath is heated up to 60 to 80 deg. Cent. (140 to 176 deg. Fahr.) and the silk worked about in it every now and then.

This treatment effects the bleaching. It is followed by a scouring in a very diluted solution of sulphuric acid. This scouring is to be followed by a washing or rinsing in plain, cold water.

Instead of the foregoing procedure, we may substitute the following:

Boiling water	60 liters
Hydrogen peroxide	20 liters
Water glass	1½ liters

These proportions are true for any quantities of Tussah silk. The actual amounts are suited to ten kilograms of Tussah silk (22 pounds).

When the bleaching bath has been satisfactorily prepared, the silk is worked round four times and then left for a space of three hours, the cover of the vessel being left in place.

After this period has elapsed, the bath is heated up to the boiling point, the silk is worked once, and the whole left for a second three-hour period. The work is then thoroughly rinsed and given a boiling-hot soap treatment.

If the bath, after it has been used, is slightly acidified and preserved in a cool and shady spot, it may be used again.

The bleaching bath dependent upon sodium peroxide affects its action by two agents: hydrogen peroxide produced by the reaction of the sodium peroxide and sulphuric acid in the bath itself. We may prepare the bath as follows:

Sulphuric acid	1.35 parts
Cold water	100 parts
Sodium peroxide	1 part
Water glass	As directed

The sulphuric acid is the commercial form. It is added to the water in a thin stream. The sodium peroxide may be sifted onto the surface, a little at a time. It is by no means to be added in the form of lumps, its action being violent and associated with more or less danger when thus added. As the sodium peroxide is slowly sifted in, the water is quietly stirred without ceasing. A little water glass is to be added for the purpose of making the bath

slightly alkaline. To determine the amount, we add a very little water glass at a time, and test continually with litmus paper. The alkaline condition will be shown by a blue effect on the paper. Only a slight alkalinity is wanted.

After the bath has been properly prepared, the silk is entered and worked around in it while the bath is still cold. This operation should last for, say, half an hour. Next, the bath is heated to 50 to 60 deg. (122 to 140 deg. Fahr.), and the silk worked in it for another half-hour. After this, the temperature is gradually pushed on up to the boiling point.

By this time, or perhaps even earlier, the liquor is to be retested to see whether it has lost its alkalinity. If so, a little water glass is to be added—enough to bring it back. The bath is to be raised to the boil and then left to cool for six or eight hours, the silk steeping init. This may be repeated a number of times. The steeping may be extended to twelve hours if desired.

Eventually, the silk is removed and rinsed twice in fresh water. It is then scoured in a weak solution of sulphuric acid and again rinsed twice in cold water. Next, the silk is treated in a boiling-hot soap bath and then rinsed. The soap bath may be prepared in accordance with the following recipe:

Water	1,000 parts
Marseilles soap	5 parts

If it is desired to produce a more even bleaching action by the sodium peroxide method, we may use the following recipe:

Sulphuric acid	2 parts
Sodium peroxide	4½ parts
Water	100 parts

I give the foregoing recipe from Gandswindt. The sulphuric acid specified is the commercial article. Apparently, the requirement to use a less weight of the acid than of the sodium peroxide is wrong. However, I give the proportions he specifies.

If a lesser bleaching action than that producible by the preceding recipe is desired, that recipe may be altered by reducing—in the same proportion—the specified weights of sulphuric acid and sodium proxide.

In all cases care is to be exercised to put the sulphuric acid in the water as the first addition. The sodium peroxide is to be added very gradually, and only to a cold solution of sulphuric acid.

The bleaching bath may be used continuously. The total weight of the body of liquor may be thirty times that of the Tussah silk fiber.

The following is a procedure which has been ascribed to Silbermann:

One hundred parts of boiled Tussah silk which has been freed from all soap are introduced into a bath consisting of 2,500 parts of water at 30 deg. Cent. (86 deg. Fahr.) in which has already been dissolved 90 per cent of sulphate of magnesia that is free from chlorine. The fiber is worked in this bath a number of times. An addition of 25 to 30 per cent of finely powdered sodium peroxide is added, with care, in small quantities. These percentages are to be understood as based on the weight of the fiber. The additions of sulphate of magnesium and of sodium peroxide are to be made to cold liquors which contain at the time no silk. In fact, the bath should be well stirred after each chemical is added and before the silk is entered. After the entrance of the fiber, the bath may be heated to 80 to 95 deg. Cent. (176 to 203 deg. Fahr.).

In the course of one and a half or two hours the foregoing treatment should be at an end. The silk is removed. The liquor will probably have a milky appearance from the presence of precipitated magnesium hydroxide. This condition is to be removed by the addition of sulphuric acid. The silk is then re-entered and worked around for a space. It is then washed. Next, the fiber is given a treatment, lasting one hour, in a boiling-hot soap bath. Finally it is washed.

In the view of a foreign authority, himself a dyer of Tussah silk, this fiber has a greater affinity for dyestuffs than is possessed by mulberry silk. In fact, Tussah silk may be used to illustrate the rapidity with which dyes can be absorbed.

For example, there are basic, acid and substantive dyestuffs which will be so quickly absorbed from a warm bath that the bath will be exhausted in one or two seconds. The dyestuff may be 2 or 3 per cent of the weight of the silk.

The extraordinary rapidity with which Tussah silk attracts the dye is undoubtedly the principal reason why it is difficult to dye this fiber in an even manner. Quick dyeing means, generally, uneven shades. It is desirable, then, to slow down the operation.

Bast soap may be used in dyeing, in consequence of the rapid action which is to be expected, unless some precautionary measure is taken. But the "bast" liquor resulting from the scouring of Tussah silk is not the thing. The bast liquor desired is that which results from the boiling off of mulberry silk. If this is unavailable, then we may turn to Marseilles soap. In fact, it is recommended on good authority as being just as good as the liquor from true silk.

When basic or substantive dyestuffs are to be used with Tussah silk, it seems to be advantageous to add a small amount of acetic acid to the dye bath. With acid dyes, sulphuric acid is substituted.

The additions of acid are to be made slowly in the cases of substantive and acid dyestuffs. Gandswindt also considers it "preferable not to raise the temperature so quickly to boiling, since (in his experience) boiling is unnecessary and even harmful. Tussah is not a homogeneous filament like true silk, but consists of a bundle of fibers which are dissociated into their elements by prolonged boiling. Tussah frills out in boiling, and the extremely delicate, fine fibrils easily felt together to such an extent that this cannot be rectified by any amount of stretching on the wringing-post."

Tussah silk may be appropriately dyed in the range of temperature 75 to 80 deg. Cent. (167 to 176 deg.

Fahr). The temperature is to be obtained gradually, and the acid is to be carefully added.

It is understood that all silk dyes may be applied to Tussah fiber, provided this fiber has been properly scoured. However, the Tussah silk may require a bleaching operation.

The basic dyestuffs have a special affinity for Tussah silk. They may be dyed appropriately in a bath containing a fatty soap. The dyestuffs draw even at a medium temperature. Light, delicate shades are often dyed on Tussah silk with basic dyestuffs.

For the acid dyes, the bath may be appropriately soured with sulphuric acid. Not a great deal is to be used. If the dye distributes well, then simple water containing a little sulphuric acid in addition to the acid dye may be used. But if the dye distributes with difficulty, the bath should contain soap.

The substantive dyes are generally suitable for Tussah silk. The affinity is very considerable. Soap is to be used in cases where uneven dyeing is to be feared. Otherwise it is not essential. The temperature may be kept as low as 60 to 75 dg. Cent. (140 to 167 deg. Fahr). It is proper to add Glauber salt, common salt, or soda and soap; but such an addition is not to be considered essential.

The mordant dyestuffs do not seem to have come into commercial use for Tussah silk. At any rate, Dr. Gandswindt is unaware of such use.

The vat dyes (including the sulphide colors) have, it would appear, not come into service in connection with the commercial dyeing of Tussah silk in so far as the knowledge of this same expert goes. He sees, however, no reason for excluding these dyes, since Tussah silk possesses great resistance to the alkalies.

Tussah silk may be weighted and dyed black by certain methods applicable also to mulberry silk. In illustration of this statement, the following double recipe may be adduced:

(a)	Fustic	60 per cent
	Ferrous sulphate	20 per cent
	Copper sulphate	5 per cent
(b)	Logwood	300 per cent
	Soap	40 per cent

First, the portion (a) of the recipe is employed as a guide to the preparation of a dye bath which is to be used to produce a bottom color. After this dyeing operation has been completed, the work is hung up to oxidize in the air.

Next, the portion (b) of the recipe is followed in producing a dye bath to be used in topping the bottom color already on the fiber. This topping operation is to be carried out at a temperature somewhat below the boiling point. If cutch is used for bottoming, the best temperature is 60 to 70 deg. Cent. (140 to 158 deg. Fahr.).

Certain azo dyestuffs that dye black may be used to dye Tussah silk from an acid bath. The black is said, however, to be deficient in fulness.

Tussah silk that has been dulled because of the use of boiled-off liquor from mulberry silk may be brightened and lustered much in the same way as ordinary silk fiber. That is to say, the bast liquor from ordinary silk is a kind of emulsion containing the sericin and the fatty acid of the silk in a state of extremely fine suspension. On issuing from this bath the [ordinary] silk has apparently lost its luster and feel, and the color is dirty and dull. Something similar is to be expected when Tussah silk is dyed in a bath containing boiled-off liquor from true silk.

An acid bath is to be considered proper to remedy the matter, to a greater or lesser degree. Sulphuric, acetic or tartaric acid may be used.

Moyret is understood to be sponsor for the following method of dyeing Tussah silk black: First, the silk is to be discharged by means of a diluted solution of caustic soda, the temperature being in the range 60 to 80 deg. Cent. (140 to 176 deg. Fahr.).

The silk is then to be mordanted once or twice with the so-called "nitrate of iron." The mordant is to be fixed with a solution of caustic soda. After this impregnation with an iron mordant, we dye the silk in a weak bath containing the yellow prussiate of potash.

The effect of the yellow prussiate of potash on the iron is to produce the color known as Prussian blue. This is, in the present case, to be viewed as a bottoming color. The procedure is, in fact, similar to that already given where fustic, ferrous sulphate and copper sulphate were employed in a first dye bath. However, the reader is not to regard the two processes as equivalent. They are alike in one point—and this one point is the only one I desire to emphasize just now—and that one point consists in the fact that in order to get a black we first produce a bottom color. In the present instance the color put on is Prussian blue.

After the bottom color is on, we work the Tussah silk in a rather weak bath of chestnut extract and then put it through a bath of pyrolignite of iron (black liquor). After these two treatments, we give them over again, first the treatment with chestnut exract and then one with the pyrolignite of iron.

The foregoing treatments with chestnut extract and pyrolignite of iron are not given for the purpose of weighting the silk, but for the purpose of saddening the shade.

They are followed by a dyeing with logwood and soap, and a brightening in a bath containing olive oil in an amount from 6 to 8 per cent of the weight of the silk. This is the topping operation.

In the preceding account of this method of dyeing Tussah silk black by bottoming with Prussian blue and topping with logwood we were required to use "nitrate of iron." This is a product which contains, despite its name, no nitrogen whatever. The article meant is not the true nitrate of iron (ferric nitrate). In fact, the "nitrate of iron" meant consists of the following ingredients: Ferric sulphate, basic ferric sulphates, and ferric sulphate-nitrates. There is no ferric nitrate nor ferrous nitrate present. The name "nitrate

of iron" is an error. It seems to have gotten into use because nitric acid is, or may be, employed in the manufacture.

The "nitrate of iron," used so much in silk dyeing, may be prepared by heating a solution of ferrous sulphate with nitric and sulphuric acids.

A considerable number of years ago two investigators, Liechti and Suida, examined a number of commercial "nitrates of iron" and found that most of them corresponded to a certain chemical formula. This formula was, it appears, found by Moyret to represent the best form of the "nitrate of iron" for the dyeing of silk.

It may interest some of my readers, though perhaps not all, to have an account of a practical method of preparing this article, so widely used by dyers of silk.

The vessel for making the product may be one of cast iron, stone or wood. It is to be a closed affair provided with a wide tube through which nitrous gases and other products may escape. There should be openings through which various ingredients may be introduced.

In order to produce 100 parts of the "nitrate of iron" at the density indicated by 90 deg. Tw. (1.450 specific gravity), we proceed as follows:

The proper amount of ferrous sulphate (copperas or green vitriol) is introduced into the aforesaid vessel, and the opening closed. The "proper amount" is seventy-two parts; but if the crystals contain much mother liquor, the amount will probably have to be greater.

A diluted mixture of sulphuric and nitric acids is introduced into the vessel in such a way as to be poured in in a gradual manner upon the ferrous sulphate already in the container. The whole is to be stirred. The sulphuric acid is to be at a density of 1.840 specific gravity (168 deg. Tw.); and the nitric acid, of 1.355 specific gravity (670 deg. Tw.). The sulphuric acid is to amount to six or seven parts; and the nitric acid ten to fifteen parts. The mixture of acids is to be diluted a trifle.

In consequence of the intermingling of the ferrous sulphate and the diluted mixtures of acids, a reaction will be set up. This will result in the generation of nitrous gases. For these, an exit has already been provided. The escaped nitrous gases may be considered in bombonnes.

No attempt is made to heat the contents of the container until the natural reaction has subsided. After this occurrence, the reaction may be completed by introducing steam. When no more gas is given off, the reaction is to be regarded as at an end.

It will be observed that no heat has been externally applied, and that what heat has been employed has been introduced in the steam. It is to be understood that wood may be very well employed as a material for the container.

After the completion of the reaction, the liquor is to be transferred to suitable containers or vessels and permitted to cool and settle.

We are cautioned to regulate well the reaction, lest it become excessively violent. If we disregard this caution, insoluble basic sulphates may be expected to form. In case this takes place, there will be more or less loss of material and the solution itself may not be sufficiently basic.

When right, the "nitrate of iron" formed will have a deep red color and will contain around 17 per cent of ferric oxide. There should be but little ferrous salt of hydrochloric acid. Tested with the nitrate of silver, there should be no precipitate. If diluted with a good deal of water, a sample of the "nitrate of iron" should disclose only a blue color when treated with red prussiate of potash. Nor should there be a precipitate.

Ferric chloride is an impurity not wanted. It "dissociates very incompletely, and ferrous sulphate impedes the dissociation. The same is the case with sodium sulphate (anhydrous Glauber salt), hence the presence of these salts is objectoinable. The commercial products contain, as a rule, some nitric acid which has escaped decomposition. Products of the same composition vary often in their tinctorial properties, especially for silk dyeing, and their value is best estimated by comparative dye trials."—Silk.

Chromates of Lead in Dyeing and Calico Printing

Chrome Yellow, or Chromate of Lead—Dark Ambers—Principles—Light Straw—Lemon Yellow—Chrome Amber—Dark Chrome Yellow—Chrome Yellow

By W. B. NANSON

THE salts of lead and chromium have completely superseded the use of vegetable dyestuffs for the dyeing of yellows, oranges and most kinds of greens upon cotton. The shades that they produce may possibly be matched by some of the coal-tar dyestuffs, but on account of the weight they add to the goods or yarns and their superior fastness under certain conditions these mineral colors are, or should be, very extensively employed. The cost of their production is low, and they impart to the cotton an extra weight which cannot be obtained with the aniline dyestuffs. On account of their extreme fastness to

light we advise their use in the dyeing of yarns and cloths to be used in the manufacture of tents, awning cloths, and for all outdoor decorative purposes.

Chrome yellow is fast to light, acids and soap. The shade is, however, turned brownish by sulphureted hydrogen and orange by alkalis.

Chrome orange is fast to light soap and alkalis, but is turned yellow by acids.

Chrome green is fast to light, soap and acids, but is deadened somewhat by alkalis.

Yellow is the lightest and most delicate of the primary colors. In the natural gray, its power is, therefore, greater than that of the other two, being more allied to light.

In artificial light, the purest yellow loses much of its intensity, and can scarcely be distinguished from white. This arises from such lights being generally of a yellow tone, and consequently diffusing this color over all objects within their influence. In daylight its effect is that of gaiety approaching to gaudiness, and its predominance is generally offensive to the eye.

There is no color that requires more management than yellow. This color is almost always employed in its purest and brightest hues; while the other colors which, according to their relative powers, ought to predominate in intensity, are very generally much inferior. Whether this proceeds from the ease with which it is produced in dyeing, or from a desire to produce a striking effect, we know not; but its abuse in this way must be apparent to all people of taste who have paid any attention to the matter. It is, however, in its various tints and combinations of the greatest value in producing brilliancy and richness.

Yellow combines with red in the production of orange color, and with blue in that of green, which colors are its melodizing tones. Its contrasting color is purple, resulting from the combination of the other two primaries (red and blue). The hue in which yellow predominates is called citrine, a compound of orange color and green.

Yellow is the most powerful of the positive colors, and consequently the least agreeable to the eye, when unaccompanied or when predominating in a pure state. Being the lightest of positive colors, this color, next to white, forms the most powerful contrast to black. There are fourteen varieties of yellow, according to Syme's nomenclature, but what is meant here by yellow is the color of the yellow jasmine, or deepest hue of lemon. Yellow, of course, forms a component part of all the tertiary or neutral hues, either in predominance or of subordination.

Chrome Yellow, or Chromate of Lead

The color of this pigment is bright yellow; it may be communicated to cotton goods by the consecutive application of solutions of acetate or nitrate of lead and bichromate of potash or soda; or the oxide of lead may be first fixed on the goods in an insoluble state, as carbonate tartrate, or sulphate. It consists of one equivalent of chromic acid and one equivalent of oxide of lead and may be expressed by the equation PbO. CrO.

Acetate of lead may be obtained by exposing metallic lead to the action of acetic acid, either as a liquid or as a vapor, and to the air; a portion of the acid is decomposed, and carbonate of lead is formed, which is then easily decomposed by another portion of the acid; the latter combining with the lead, forms acetate of lead, and the carbonic acid is evolved.

Nitrate of lead is prepared by dissolving litharge (protoxide of lead, PbO) in nitric acid, and evaporating the solution, which leaves a crystalline mass, the crystals of which are white and generally opaque, and soluble in 7½ parts of cold water. The nitrate of lead, when prepared in this way, contains one proportion of oxide, and one of nitric acid, but by boiling the salt for some time over litharge, the acid will combine with two, three or even six proportions of lead, forming what are termed basic salts. This fact has been known to practical dyers for a long time, and it is made available for the purpose of dyeing orange or dark shades of yellow.

A solution of nitrate of lead may be partially decomposed by ammonia so as to form several subnitrates. On adding a very small quantity of the alkali a subnitrate is formed, composed of one equivalent of acid and two of the base; a little more produces a compound of one equivalent of acid and two of the base; a little more produces a compound of one equivalent of acid and three of base, and an excess of ammonia precipitates a salt composed of one of acid and six of base. Potash (or soda), then passed again through the lead solution, washed and dried.

The proportion of the two salts varies according to the particular hue and depth of color wanted, and for deep shades the goods are passed several times through the lead and chrome. We might say here that nitrate of lead makes for a redder and rather duller shade of yellow than the acetate. The proportions used by the old-time dyers—who, by the way, understood this chrome dyeing business—were 10 pounds cotton, 4 ounces nitrate of lead, 12 ounces acetate of lead, 6 ounces bichrome. If the shade was to be a little darker they used the following: Five ounces nitrate of lead, 11 ounces of acetate of lead and 6½ ounces of bichrome.

A very red shade of yellow requires the following proportions: Eight ounces nitrate of lead, 8 ounces acetate of lead, 14 ounces of bichromate.

Dark Ambers

When dark ambers are wanted, the proportion of nitrate to acetate of lead is increased; but this last recipe is the highest proportion of bichromate to the quantity of lead, and we need hardly say that anything used over that is wasted. The proper proportion for dyeing yellow, even were the lead salts entirely absorbed by the goods, is as near as possible one-half of the bichromate to the lead,

whether nitrate or acetate is used. All above this is direct loss; and as the lead salt is never all taken up by the goods, the proportion of chrome may be less than half the weight of the lead used.

Practice has dictated these quantities, and the results of practice are more to be relied upon than theory. Whether, then, is the theory or the practice in this case at fault? It will be observed that the depth of the redness of the shade is in proportion to the amount of nitrate of lead used, and that it is the oxide of lead in the acid which gives the dye with the chromic acid of the bichromate. Now, every 100 ounces of nitrate of lead contains about 67½ ounces of oxide of lead, and every 100 ounces of acetate of lead contains about 68½ ounces of oxide of lead; therefore the same weight of acetate of lead should give a richer dyer and take up in proportion a little more bichromate than the nitrate, so that the practice of giving more bichromate with the nitrate of lead must be an error. It must appear that the extra quantity is given for the purpose of reddening the hue of the yellow.

How this is effected will be seen when a piece of cloth is put into acetate or nitrate of lead. The cloth is merely soaked with the salt, there is no fixing of the oxide on it, and if put through water it would be completely washed off. In this state, therefore, the salt cannot form a dye; it must be rendered insoluble. This is effected, as we have observed above, by immediate transportation from the salt of lead into the bichromate, where there is formed the insoluble salt of lead. That portion of the salt which obtains within the hollow fibers of the cotton becomes fixed, but all that is upon the goods external to the fibers is loose and either falls off in the chrome tub or is washed off in the final washing. This portion probably constitutes one-half, creating so much less; and it is well known that where chrome yellow dyes were produced to any great extent in the dyehouses of the past, the chromate of lead formed in the chrome tub and the washer, amounting in a short time to hundreds of pounds, was collected and sold for a low price to painters.

In addition to this loss there is another evil attending to this method. Say that 100 pounds of yarn is to be dyed a red shade of lemon yellow; this will take 160 ounces of the salt of lead, which will contain 53 ounces of acid and 107 ounces of oxide of lead. If we suppose that all the lead salt is taken up by the goods, which is hardly ever the case, the 160 ounces should take only 73 ounces of bichromate; though, as we have seen, they take 140 of the bichrome, leaving 67 pounds of bichrome to be acted upon by the free acid for the purpose of giving a red shade.

The deleterious effects of free nitric acid in the chrome bath will be evident by adding a few drops of nitric acid to a strong solution of bichromate; the color remains unchanged. Dip a piece of paper in this and it takes a dark orange; expose it to the air and in fifteen minutes the color will have entirely disappeared. A similar change is effected upon the goods with the bichrome on them when taken out of the chrome tub and exposed to the air.

Principles

All these evils might be obviated by a little attention to principles. We have shown that it is the oxide of lead which forms the color with the chromic acid. This oxide is insoluble and can be fixed in this state in the goods previous to their entrance into the chrome bath. This can be effected by passing the goods from the lead solution through clear lime water; this combines with the acid of the lead solution and leaves the insoluble lead oxide on the fiber. If this be put through the ordinary chrome bath the result will be a very dull yellow, as the affinity of the chromic acid for the lead is prevented from exercising its power by the potash or soda which is in union with it; but if, previous to putting in the goods, a few drops of sulphuric acid be added to the chrome solution, the chromic acid is set free, and combines freely with the oxide of lead upon the cloth, giving a beautiful yellow.

Care must be taken to add no more acid to the chrome bath than is necessary to set the chromic acid free. It the goods are limed after the lead, free lime may become a factor in the chrome bath, and it would therefore be safer to wash after liming. Any free acid, it must be remembered, is a dangerous thing in the chrome bath. The following recipes are old-timers, but have withstood the effects of time; they are all given for 10 pounds of *bleached* yarn:

Light Straw

To a tub of cold water add 4 ounces of lead acetate previously dissolved; work the yarn in this for fifteen minutes and wring out. Into another tub of cold water add 2 ounces bichromate; work the yarn through this for ten minutes, wring out, and pass again through the lead solution for ten minutes; wash and dry. For a Leghorn dye, as above; but add along with the chrome ½ pint annatto-liquor. Different depths and tests may be obtained by using more or less of these stuffs, without varying the mode of working.

Lemon Yellow

Into a tub of water put 1 pound of acetate of lead previously dissolved; work the goods in this for fifteen minutes and wring out. Into another tub of water put 6 ounces of bichromate in solution; work the goods fifteen minutes through this and wring out; then work again ten minutes in the lead solution, wring out, wash and dry.

A deeper yellow is made by using twice the weight of materials, or by passing the goods twice through the same materials, finishing out of the lead as before. It is, however, the opinion of the writer that where yellows are required heavier and redder than lemon yellow it is better to use the lead salts in a basic condition.

Chrome Amber

To a tub of cold water add 1 pound of acetate of lead

and 1 pound of nitrate of lead; work the yarn in this for half an hour and wring out; then in a tub of warm water add 12 ounces bichrome and work the goods through this for fifteen minutes; expose to the air for half an hour; then pass again through the lead and chrome, working the same time in each as before, and allow an hour's exposure to the air; then pass again through the lead, wring out, wash and dry.

Dark Chrome Yellow

In this recipe the lead salt is applied to the goods in the shape of a plumbite by adding 1 pound of acetate of lead in solution to the tub in cold water, and then adding a solution of caustic soda until the precipitate of lead oxide first formed is redissolved, being careful not to add more caustic alkali than is required for this solution. Work the goods through this for half an hour, and wring out; then add 8 ounces of chrome, previously dissolved, to another tub; work the goods in this for fifteen minutes, wring out, wash and dry. Two or three ounces of sulphate of zinc may be added to the chrome bath with good effect so as to neutralize any free alkali. If a red deep amber yellow be required, ½ pint of muriatic acid may be added to the chrome solution.

This plumbite of lead mordant possesses the advantage of saving time. It does away with any intermediate liming between the lead and the chroming. Moreover, yellows dyed by alkaline solutions of lead (plumbites) are not so liable to redden after dyeing and are not so dusty; in other words, are cleaner and faster. Again we have shown that when acid salts of lead are used to dye yellow there is always a large quantity of free acid accumulating in the chrome bath, which is usually a prominent bath where much heavy yellow is dyed.

This will cause inequality in color between one lot of goods and another; but when alkaline salts of lead (plumbites) or subsalts (subacetate) are used no acid is liberated, and therefore if we are dyeing 100 pounds in 10-pound lots at a time, one after the other, without a new liquor for each, only adding a little lead and chrome to the old baths, the last 10-pound package dyed would have the same chance as the first of being uniform in shade. Thus the advantage of alkaline salts of lead or subacetates when dyeing chrome yellow. For straw color and other bright, light shades we advise the acid salts of lead, using fresh solutions for each lot.

In view of the above, it is customary for the dyers of the present day when dyeing a lemon yellow, for instance, to prepare a stock tub with 100 pounds of brown sugar of lead in 80 gallons of water, to stand at about 16 deg. Tw. Fill a vat with 40 gallons of water and add 3 pints of stock liquor and 1 gallon of caustic soda lye, 71 deg. Tw.; turn the yarn about three times in this bath cold, wring and pass through chrome bath cold, wash and dry. The chrome bath is prepared, for a vat of 40 gallons, with 3 pounds bichromate of soda and 6 ounces of sulphate of zinc. This is a sample of a plumbite or alkaline lead bath and is suitable for light pure shades of yellow.

Chrome Yellow

A solution of basic lead acetate (subacetate) is prepared by boiling for four to five hours 60 pounds litharge (protoxide of lead), 120 pounds brown sugar of lead and 35 gallons of water.

The yarn is worked in the basic lead acetate solution, which, according to the depth of shade required, should have a specific gravity of 3 to 8 deg. Tw. for about one-half hour. It is now well wrung, shaken and passed through a bath containing 1 to 3 pounds bichrome in 10 gallons of water, with or without the addition of ½ to 1 pound of sulphuric acid. The yarn is finally thoroughly washed and dried.

If the color has not been completely fixed upon the fibers, cotton dyed with chrome yellow is liable to dust when shaken. In order to prevent this, the yarn should be treated with a weak emulsion of oil before drying.

A better yellow is produced by working according to the following method: The hanks are turned a few times in the solution of basic lead acetate, taken out and placed in a dyebeck. The lead acetate is now poured over them and the hanks are allowed to remain in the solution overnight. They are taken out in the morning, well wrung and turned ten times in a cold bath containing 3½ pounds quicklime which has been carefully slaked with boiling water.

After this the hanks are carefully wrung out and turned four times in a bath containing 5 pounds bichrome, 6 ounces of alum and 1 pound sulphuric acid. The yarn is finally thoroughly rinsed, oiled and dried.

Another method, highly recommended:

Dissolve, boiling, 100 pounds brown sugar of lead and 50 pounds of litharge in 36 gallons of water.

Pass the yarn through the lime water, cold, at 1½ deg. Tw., and wring; then work in a solution of basic lead acetate, prepared by diluting the above stock liquor with cold water to 10 deg. Tw., wring out and pass through another tub of lime water at 1½ deg. Tw. The lead liquor is used continuously and maintained at the same strength by the addition of fresh stock liquor. The chrome bath is made up with about 6 pounds bichromate of soda per 100 gallons, and is from time to time freshened up with fresh bichromate solution—being used continuously. After passing through the chrome bath the yarn is turned a few times in water containing one part of hydrochloric acid per three hundred parts of water, finally well washed and dried.

All sediment of yellow chromate of lead that may be found in the various tubs or washboxes, etc., in the dyehouse should be carefully collected; it is valuable and may be used over again by dissolving it in cold caustic soda or lime water.

While most of the methods we have given refer to yarns, they are equally applicable to piece dyeing by

using the same strength and quantities in the ordinary one or two box padding machine, for instance. The goods can be run continuously once or twice in the two-box machine, with the first box set with basic acetate at 7 deg. Tw. and the second box with lime water. Take from this and chrome on a single-box machine, wash and mangle.

Subchromate of lead $2PbO.Cr.O_3$ (chrome orange): This salt is always formed when the neutral chromate $PbO.Cr.O_3$ (chrome yellow) is treated with a quantity of alkali insufficient to decompose it. For this purpose a boiling bath of clear water is prepared. In this the yarn dyed with the basic chrome yellow is turned very rapidly five to six times until the orange shade is fully developed. It must then be quickly removed (or the color will be stripped) and rinsed twice.

The yarn is finally treated in a bath containing soap, a small quantity of soda ash and cottonseed oil, wrung and dried without rinsing.—The Textile American.

Notes on the Dyeing of Direct Blacks on Cotton Piece Goods

Dyeing Direct Black as a Ground to Aniline Black—A Medium Black—A Dark Black—Treating Cotton Pieces Continuously—An Improved Method of Treatment—Three Types of Plant—Their Advantages and Disadvantages

By RAFFAELE SANSONE

Dyeing Direct Blacks as a Ground to Aniline Black

In some works Direct Blacks are darkened and rendered faster through an after-treatment in an Aniline Black bath, for the purpose of obtaining a much deeper black than is possible by employing the former. This treatment permits the production of goods which clients will frequently believe were dyed entirely with Aniline Black, but goods which have the advantage of possessing a greater strength, and which do not green—or in which, should greening take place, it is masked by the Direct Black ground underneath.

With the above process the cotton can be dyed a light shade with a Direct Black, being topped with a strong Aniline Black bath; can be dyed a medium shade with the Direct Black, being topped with a medium strength Aniline Black bath; or can be dyed with the Direct Black a dark shade, being topped with a weak Aniline Black bath—all three combinations being of value to the dyer.

When the direct color is dyed in a light shade, the cotton fabric is treated in a bath generally containing from ¾ to 1 per cent of the coloring matter, by exhausting, or not, with salt or sulphate of soda. The dyeings are then rinsed and introduced into a bath containing, on the weight of the material treated, 10 per cent aniline salt, 14 per cent hydrochloric acid 21 to 22 deg. Be., 3½ per cent sulphuric acid at 60 deg. Be., and 13 per cent bichromate of soda crystals.

Dyeing for half an hour in the cold, and then warming slowly to 60 deg. Cent., rinsing, soaping, again rinsing and drying, this black comes to cost more than any of those mentioned above, and may not always be convenient. For some instances it may, however, be useful, especially when it is desired to impart to the goods, to a certain extent, the handle and smell of Aniline Black dyed goods, with the least possible tendering and a certain waterproof effect.

The black produced by the last process is among the darkest and fastest. Owing to the more superficial deposition of the coloring matter lake, it is, however, more liable to rub on whites, a defect which can in part be avoided by lengthening the heating process and conducting this in several stages, or by conducting the whole treatment in the cold; the final warm soaping bringing about, in this instance, the development of the black.

A Medium Black

When a medium black is dyed with the direct color, from 2 to 3 per cent of this last is used by exhausting the dye bath with salt; or stronger solutions may be used, leaving out all additions of salt, rinsing well after drying, and passing through a bath which usually contains, on the weight of the goods, 5 per cent aniline salt, 7 per cent hydrochloric acid 20 to 21 deg. Be., 2 per cent sulphuric acid 60 deg. Be., and 3½ per cent bichromate of soda crystals.

Here the goods are first treated in the cold for about thirty minutes, and then during warming to 60 deg. Cent. After dyeing, the usual rinsing and soaping operations follow.

A Dark Black

Should the direct color be dyed in a dark shade, from 5 to 6 per cent of the direct color is used, and the Aniline Black topping liquor is often prepared with the following ingredients: 2 per cent aniline salt, 3 per cent hydrochloric acid 20 to 21 def. Be., ¾ per cent sulphuric acid 60 deg. Be., and 3 per cent bichromate of soda crystals.

Also in this last case, the treatment of the cotton cloth is conducted first in the cold dye bath, and then during warming, and a thorough rinsing and soaping is made to follow. The black, because of containing less Aniline

Black than the preceding, is faster to rubbing, although not as dark.

The Plant Required

A plant sometimes employed for dyeing cotton fabrics in Direct Blacks and topping them in an Aniline Black bath is shown in *Fig.* 1.

This consists of four enameled iron jiggers (1, 2, 3, 4), the first two (1 and 2) and last (4) of which contain two lower guiding rollers (d, e, d, e, d, e), three upper guiding rollers (a, b, c, a, b, c, a, b, c), and a special device by means of which the cloth can be run from one wooden shaft to another (A, B, A, B, A, B), the direction of the running being inverted automatically when each end or border of the piece has been reached. The third jigger (3) is of somewhat different construction to the above. This contains two lower guiding rollers (g, h) and one upper guiding roller (f). The cloth in this instance is run between two wooden shafts (C and D), which are, however, kept below the bath of treatment in order to avoid any exposure to the air or irregular impregnation or heating. All four jiggers are warmed through closed enameled iron steam-heating coils. The first jigger (1) is used for the treatment with the direct coloring matter; the second (2) for rinsing after this treatment, and the fourth (4) for giving a rinsing and soaping. The third jigger (3) is used for the dyeing operations conducted with one-bath Aniline Black.

Operation of the Plant

The above plant is often worked continuously as follows: The operatives place before the first vat, on a strong enameled iron truck, the wet boiled-out material rolled on wooden shafts. One of these is then entered on the first jigger (1), after having previously prepared the bath required for its treatment and fixing the loose end of the material to an empty shaft kept expressly for the purpose. The material is then run between the two shafts for a certain number of turns until the required shade has been produced.

After this the cloth is rolled on one of the shafts, and this is taken off the first jigger and placed on the second (2), where it is run backwards and forwards through a bath of rinsing water, often entered at the top of the jigger and let out through a hole in the bottom. In the meanwhile the first jigger is used for dyeing a second shaft of material in the same manner as the first.

On leaving the second jigger the cotton fabrics are taken and entered in the third jigger, before the entrance of the Aniline Black bath, which is introduced later, turning the material in it for a certain time, first in the cold and then in the bath gradually warmed to 80 deg. Cent., or even higher, in accordance with the nature of the black to be produced. When in this way the desired intensity of shade has been produced, the steam is turned off in the closed steam coil, the bath is run off, and the whole of the cloth is rolled on one of the shafts, being then taken out and entered on the last jigger (4) for soaping and again rinsing with running water. In the meanwhile the operatives have charged and rinsed in the second jigger the second lot of cotton cloth, charging in the first jigger a third lot, etc., etc. In this way the treatment of large quantities of cotton cloth can be conducted, bringing down the cost of the treatment.

Disadvantages of This Method

The above means of treatment, although very widely developed everywhere, offers at present several disadvantages which should be carefully noted. Some of these are as follows:

1.—A new bath has to be employed for each roll of cloth entered in the plant, requiring each time the warming, from cold, of the dye baths in the first, third and fourth jiggers, and the maintenance of the temperature reached till the completion of the treatment conducted in each case, occasioning the use of more steam than would be necessary under other conditions for obtaining the same results.

2.—Each roll of cloth requires a bath of its own which is scarcely ever exhausted or completely utilized, constituting, with the present prices of Direct Blacks, aniline oil, bichromate of soda, and acid, a great increase in dyeing expenses.

3.—The necessary amount of labor is very great, since the operatives not only have to carefully attend all dyeing and rinsing operations but have also to prepare new baths continually and to charge and discharge the rolls of cotton cloth to the first jigger and from this to the following jiggers, and to the truck or small wagon for transportation to the drying department.

4.—A fairly large space is taken up by the treatment of comparatively small lots of material.

5.—Through the continual need of preparing new baths there is a danger of obtaining differences in shade when only one color is desired.

Treating Cotton Pieces Continuously

When it is necessary to treat the pieces of cotton cloth as continuously, rapidly and completely as possible, a plant constructed on the principle shown in *Fig.* 2 is sometimes employed to advantage.

This consists principally of a long iron glass-lined vat, divided through partitions of the same material into six compartments (A, B, C, D, E, F), the bottom of each of which has a perforated double bottom and can be heated independently by a closed iron glass-lined steam coil to a temperature regulated through thermometers fixed where most convenient. Each compartment has also an upper and lower series of guiding rollers, and at its end a pair of squeezing rollers (1, 2, 3, 4, 5, 6).

At the beginning of the vat, and at a certain height, are supported through a strong wooden—or iron glass-lined—frame two half tubs (V and W), also of enameled iron,

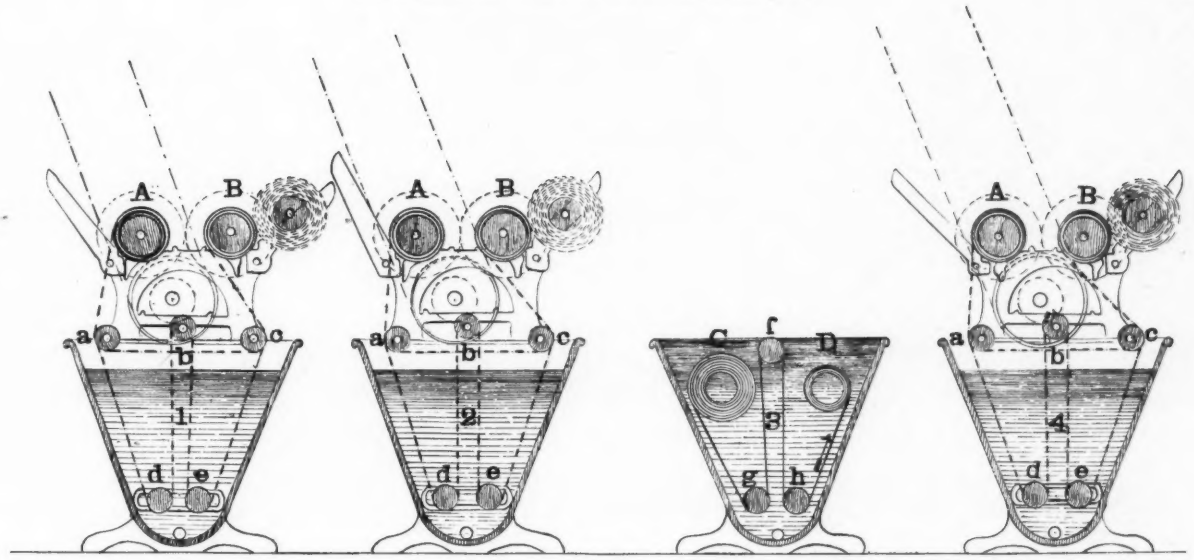


FIG. 1

the first of which (V) is employed for the distribution of a concentrated Direct Black bath which may be poured through a tap at the beginning of the first compartment (A) in the bath of treatment, escaping slowly from the bottom of the same through a tap. The second compartment (B) only receives the bath coming through this tap, and that is used as a rinsing medium, being then led to a cistern placed below the plant.

In the second half tub (W) is prepared the bath of Aniline Black required for the topping of the dyed goods. This is led through another tap at the upper portion of the third compartment (C), the contents of which, in its turn, is led by a tap to the bottom of the fourth compartment (D), and from here out of an overflow tube at its upper portion into a second storage tank, also placed below the plant. The fifth compartment (E) contains a soap bath pumped in from a preparation vat placed just behind, and all excess of which flows out into a third storage collection tank. The sixth or last compartment (F) contains running water. At either end of the plant two small wagons (G and H) enter and bring out the material being treated.

OPERATION OF PLANT IN FIG. 2

The most efficient working of this plant would require, at the start, some study and practice. The operatives first pass a cotton tape through all the compartments (A, B, C, D, E, F), and then flow in water to the desired height. After accomplishing this they prepare in the first half tub (V) the strong bath with the Substantive or Direct Black, pouring a certain number of quarts of this into the first compartment, closing the tap, adding more color, and making up the solution until the vat has been completely filled.

After this they prepare in the second half tub (W) the Aniline Black bath, pouring also in this case a certain number of quarts of the same into the third compartment (C), then closing the tap and preparing more of the strong bath to fill the said half tub. The soap bath for the final neutralizing and cleansing operations is then prepared in the vat at the back of the plant, and a portion of this is added to the water bath in the first compartment (E). The entrance of the boiled-out cotton fabric from the small wagon (G) at the front of the plant can then be begun without fear.

This runs slowly forward in the large vat, passing first through the compartment (A), in which it takes up color to produce a gray or a black in accordance with the shade desired; then being given a second passage through the exhausted bath, which is subsequently made to enter slowly into the second compartment (B), cold water entering slowly through a suitably placed tap for replacing all liquid extracted by the material. During its passage from the first compartment to the second, and from there into the third (C), the cloth is pressed between the two pairs of squeezing rollers (1 and 2), thus avoiding the useless carrying forward of the bath.

On entering in the third and fourth compartments the fabric passes several times up and down in the cold or warmed Aniline Black bath, in accordance with the process of treatment adopted, being pressed between the squeezing rollers (3 and 4) and entering finally in a soaping bath (E) which neutralizes all free acid present on the material and fixes the Aniline Black completely, supplying at the same time the material with a certain quantity of chrome soap, which latter gives it a certain impermeability that can be increased by suitable warm calendering operations.

Leaving this compartment, a further pressing between the rollers (5) sends back into the bath of treatment all excess of soap and a good portion of the unfixed Aniline

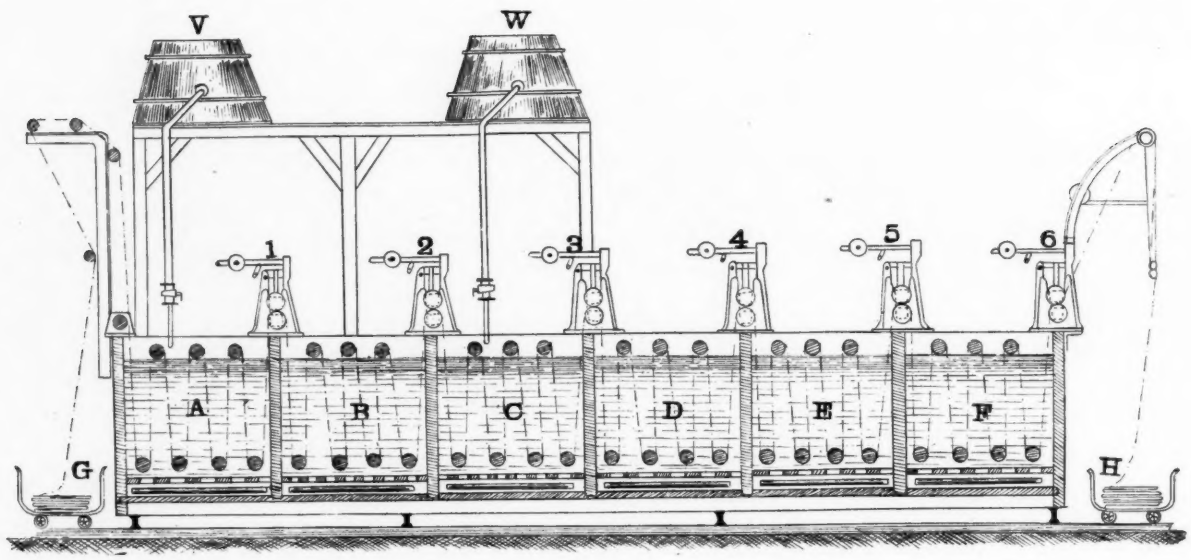


FIG. 2

Black lake. In the last compartment (F) the goods are given a final rinsing, and, after passing through the last squeezing rollers (6), pass upwards in order to be again transformed in the form of pieces on the exit wagon (H).

ADVANTAGES

The advantages of the above plant are several, and merit the notice of the dyer and manufacturer of colored goods. Some of them can be indicated as follows:

1.—No salt is employed for the exhaustion of the Direct Black bath, which remains always in the form of a solution that can be employed over and over again with a little shading color, or not; or when dyeing any black, avoiding the necessity of throwing it away; or can replace the water added from the start in the first two compartments (A and B) before and during the treatment, and be employed for dissolving the dyestuff of the strong black solution.

2.—The pressing of the material passing from bath to bath guarantees not only a neater treatment, but also a better utilization of the different baths, giving great equality to all treatment of the material.

3.—The plant can be used for producing colors where the Aniline Black bath is heated only in the fourth compartment (D), colors where the heating is conducted in the third and fourth compartments (C and D), or in none of these compartments.

4.—Through introducing at the end of a batch, the treatment of which is being ended, a waste piece of cotton cloth, changing rapidly the bath of treatment in the first two compartments (A and B), and the concentrated coloring matter bath in the first half tub (V), it is possible to change the shade of the black while the cloth is still running through the plant, entering a new batch.

5.—Should it be necessary, the plant can be used, after a convenient cleaning, for copper direct coloring matters, for treating these with bichromate of potash, for topping direct coloring matters with basic colors, etc.

AN IMPROVED METHOD OF TREATMENT

An improved method of producing the above class of blacks, and one which will undoubtedly be applied in the future owing to the greater advantages it offers, will consist in submitting the cotton material—while running continuously, first through a bath of the Direct Black, and then through a bath of the Aniline Black—to continually repeated drying operations. In order, however, to conduct this to the greatest advantage, and with the least expenditure of labor, steam and space, a plant constructed on the principle shown in *Fig.* 3 can be used to advantage.

This shows a special form of plant containing a long narrow iron vat, divided into five sections (A, B, D, E, F) through separation walls. The sections are also covered with glass. Of the five compartments, only the fourth (E) is supplied with a heating medium, all others (A, B, D, F) being destined to treat the material in the cold, and the last two vats (E, F) are the only ones supplied with squeezing rollers. Above the first and third compartments are placed two heating covers (G and H), between the double walls of which steam is circulated from a unique tap (J), all condensed water being eliminated through two steam traps. The upper portion of the covers is supplied with a powerful aspiration ventilator (indicated in both cases by P and Q). Before the first compartment is placed a high entrance frame which spreads the fabrics during their entrance from a light iron wagon (V), and at the end of the last compartment (F) another frame serving for their distribution in folded form to another light enameled iron wagon (Y).

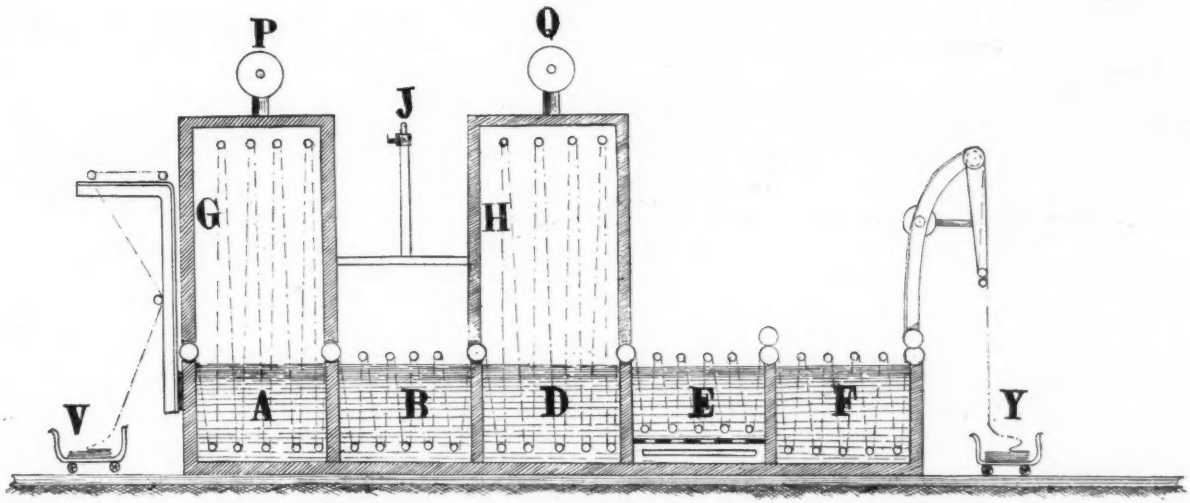


FIG. 3

OPERATION OF PLANT IN FIG. 3

The working of the above plant could be confided to any intelligent dyer, as it only offers small initial difficulties, easily overcome after short practice. The operatives' first task is to prepare in three vats at the back of the plant weak solutions of the direct coloring matter, of the Aniline Black bath, and of the soap bath; these are then caused to run slowly through the first, third and fourth compartments (A, D, E) respectively, entering at the top and being pumped out at the bottom, to be delivered back to the original vats through three small centrifugal pumps.

When the above operation has been conducted, running water is caused to pass through the second and last compartments (P and F), steam is turned on between the double walls of the two covers (G and H) through the tap (J), and the plant is placed in movement for entering the cotton cloth through the assistance of a cotton tape. The material thus enters slowly in the weak bath of the direct coloring matter (compartment A), passing upwards, directly after the first immersion, for being dried in the hot-air chamber formed just above, passing many times from the immersion bath to the hot-air chamber, for finally making its way in the rinsing bath (compartment B), colored in light gray, dark gray or black, in accordance with the speed of treatment, strength of the dyeing bath and temperature of this latter. In this all unfixed coloring matter is eliminated, and the material is cooled down, if it has been heated during the coloring operations, and makes its way in the best condition for the treatment with the Aniline Black bath contained in the third compartment (D). Here the cotton cloth pieces are treated in exactly the same way as they were in the case of the first compartment (A), only that the bath of treatment is purposely kept cold by closed enameled iron serpentines, through which cold water is run very rapidly to avoid the decomposition caused by heat transported by the warmed cloth or hot air circulated above the compartment (D).

In this case, the cloth colored with the Direct Black takes up first a thin covering of the Aniline Black bath, which during its passage through the hot air is transformed into black, being fixed where it finds itself; this coating is then covered over by other similar coatings, so regulated that the desired shade or intensity is not exceeded, which would produce a bronzing of the black.

On leaving the Aniline Black bath the goods enter the soap bath of the fourth compartment (E), and this frees them of any traces of acid they may contain, forming with the chrome salts present on the fabric a special lake, giving to the goods a certain degree of impermeability which can be increased through stronger additions of bichromate of soda in the Aniline Black bath, and the use of stronger soap baths. On leaving this bath the cloth is rinsed with running water for the last time in the fifth compartment (F), and can make its way out on the folding or plaiting arrangement which distributes it to the carrying-off wagon (Y), ready for being transported to the drying and finishing department.

ADVANTAGES OF PLANT NO. 3

The above plant, although quite a novelty for the dy accustomed to treating his goods on the jigger or on th ordinary continuous dyeing and soaping plants, offers number of special advantages that are well worth consid ering, especially in these moments of further developments in dyeing in all old and new industrial centers. Some of these can be considered as follows:

1.—By using solutions of fixed strength and increasing or reducing the speed at which the cloth runs through the plant it is possible to produce any desired gradation from a very light gray to a very jet black, often regulating the dyeing operations from a speed table.

2.—For reducing to nothing, or next to nothing, the tendering of the fabric, the hydrochloric and sulphuric

acids usually present in the Aniline Black bath can be replaced by weaker acids, and in some cases even by ammonium acetate.

3.—Through the repeated impregnations in the direct coloring matter bath and Aniline Black bath, and the repeated drying of very thin dyestuff coverings, there is less danger of producing superficially dyed materials, and the articles produced, even if containing a strong charge of the Aniline Black bath, exhibit a lower tendency to rubbing than those produced through the ordinary means.

4.—If desired, when treating very light goods, these can be given a strong filling of resin soap, of starch or of other thickenings, provided these are introduced in the last compartment (F).

5.—When not topping Direct Blacks with Aniline Black, the plant can be employed to advantage for chroming and coppering operations during the dyeing with these blacks, if the chroming and coppering baths are introduced in the third compartment in place of the Aniline Black bath, being heated instead of being cooled, as in this last case.

6.—The yield can be made very high, and much cheaper goods can be obtained than with any other means of treatment.

7.—The utilization of the dye baths can be brought nearly to 100 per cent.

[*Part V will be given in a future issue.*]

U. S. SELLS 20,000,000 PAIRS OF ARTIFICIAL SILK HOSE ABROAD IN 1922

The fact that the foreign world can on Christmas eve hang up twenty million pairs of new artificial silk stockings fresh from the factories of the United States illustrates the persistency with which our manufacturers are tightening their grip on world markets, says the Trade Record of the National City Bank of New York. Latest export figures indicate that the artificial silk hosiery sent out of the United States in the calendar year 1922 will approximate twenty million pairs. Up to the end of September they totaled between twelve and thirteen million pairs, and as they are now running at the rate of approximately two million pairs per month, the total exports of artificial silk hosiery in full year seems likely to be nearly or quite twenty lion pairs, against less than half that number in the ndar year 1921. The total value of the exports of ficial silk of all grades will be about $6,500,000 in 2, against a little more than $4,000,000 in 1921. Arial silk is, in fact, one of the few articles which show larger export values in 1922 than in 1921.

The increase in our exports of this new product of the American factory is especially interesting in view of the fact that the industry is one of comparatively recent development with us. Prior to the war most of the world's artificial silk was produced in Europe, especially Belgium, Germany and France; but with the interruptions which the war caused in the industry, the output of artificial silk yarn in the United States grew from one and one-half million pounds in 1913 to eight million in 1919, jumping to fifteen million in 1921 and a prospective twenty million in the year which ends with this month. The value of the artificial silk yarn produced in the United States in 1922 is nearly $50,000,000 and the factory value of the finished goods produced therefrom about $75,000,000.

Even this big growth in production in our factories does not seem sufficient to satisfy the demands of the United States, for the importation from foreign countries during the current year will aggregate about two million pounds with a value of $3,500,000.

The uses of artificial silk, which, as is well known, is made chiefly from wood fiber, are expanding, and it is now utilized in nearly all classes of knit goods as well as draperies, trimmings and many other lines of this general character.

The rapid growth in foreign demand for this new product of the American factory is illustrated by the fact that our export figures only go back to 1916, prior to which time the Department of Commerce did not consider artificial silk or its manufactures of sufficient importance to be included in our export figures. The total exports of all material of this kind in the calendar year 1917, the first year of record, amounted to $1,433,000, advancing to about $10,000,000 in 1919; dropping, however, with the reopening of European factories to about $8,000,000 in 1920, $4,000,000 in 1921, and seems likely to be about $6,500,000 in 1922. The growth of this new industry in the United States is illustrated by the fact that our own outturn of artificial silk yarn in 1922 is as great as that of the whole world in 1914.

U. S. SEEKS AGREEMENT ON REPARATION DYES

An agreement between the United States and the allied Governments on the distribution of German dyestuffs received in part payment of indemnities imposed by the peace treaty may be reached by Eliot Wadsworth, assistant Secretary of the Treasury, at the conferences to be held in Paris on the question of settling the army costs of the participating armies. Possibilities of this have been indicated at the White House.

Proceeds from the sale of German dyestuffs delivered to the Allied Commission on account of German indemnity payments, it has been proposed, should go toward the settlement of the army costs incurred in the European hostilities. Because of the relationship between that question and that of reparation dyes administration officials are of the opinion that the distribution of German dyes received on this account may be raised at the conference for settlement.

Senator Shortridge of California has said he expected to confer with Secretary of State Hughes on the dyes question. He introduced a resolution at the last session, which was not adopted, permitting the President to establish an agency for the distribution of the reparation dyes.

American Dyestuff Reporter

INDEX

TO

VOLUME XI

(Thirteen Issues)

July 3, 1922, to December 18, 1922, Inclusive

Subject Index

A

Subject — Page

A Quarter Century of Technical Education in Textile Chemistry and Dyeing (Olney) 181
Acid Colors: List of American
[See under "American-Made"]
A. C. S. Dye Division Papers, Spring Meeting, 1922: Abstracts of.. 265
Alizarine Dyes on Silk: The True (Emmons)..... 160
Aluminum Chloride Processes: Carbonizing Raw Wool and Noils by the Sulphuric Acid and ("Consulting Textile Chemist")..... 187
American Association of Textile Chemists and Colorists. [See under "Proceedings."]
American-Made Colors:
Group I—Acid Colors 284
Group II—Basic Colors 315
Group III—Chrome Colors 352
Group IV—Direct Colors 373
Group V—Eosines and Similar Products. Fur Dyes. Nigrosines, Induline and Oil Colors. Sulphur Colors. Vat Colors..... 411
Apparatus: A Consideration of the Various Substances Used in the Construction of Dyeing and Bleaching Utensils and (Grandage and Hadley)
[See under "Consideration"]
Application of Hydrogen Peroxide: Manufacture and (Wilson)..... 137
Artificial Silk and Its Applications in the Textile Industry (King)... 317
Artificial Silk: Dyeing of Mixtures Containing (Emmons)..... 268
Artificial Silk: Some Recent Important Developments in..... 155

B

Basic Colors: List of American
[See under "American-Made"]
Basic Colors: Notes on Some Effects Produced Through the Printing of (Sansone) 86
Benefits to Be Derived from a Standard Raw Silk Classification (Lewis) 335
Bleaching and Dyeing Tussah Silk (Emmons)..... 463
Bleaching Agent: Sodium Peroxide as a (Nanson)..... 419
Bleaching Cotton: Gain or Loss of Weight in Dyeing and..... 366
Bleaching of Cotton Piece Goods (Bailey)..... 122
Bleaching: Colors Fast to (Schwarz)..... 222
Bleaching in Laundries..... 325
Bleaching Utensils and Apparatus: A Consideration of the Various Substances Used in the Construction of Dyeing and (Grandage and Hadley)
[See under "Consideration"]
Bright Colors and Tints on Carpet and Rug Yarns (Holden)..... 209
Blue Dyes Used for Tinting White Goods in Laundries..... 130

C

Calf: Manufacture of Chrome Ooze (Jackson)..... 297
Carbonizing Raw Wool and Noils by the Sulphuric Acid and Aluminum Chloride Processes ("Consulting Textile Chemist")..... 187
Carpet and Rug Yarns: Bright Colors and Tints on (Holden)..... 209
Cellulose Acetate Silk: Dyeing of (Sanderson)..... 6
Centrifugal Extractors (Hadley and Grandage)..... 193
Chemical Control of Dyestuffs (Scott)..... 225
Chemical Research in the Power Laundry Industry (Shupp)..... 336
Chemical Solutions: Mechanical Appliances for Pumping (Fischer)
[See under "Mechanical"]
Chemistry of Dyestuffs: The New Physics, and the (Claflin)..... 219
Chromates of Lead in Dyeing and Calico Printing (Nanson)..... 467
Chrome Colors: List of American
[See under "American-Made"]
Chrome Colors: The Mordanting of Worsted Piece Dyes for Certain Fast (Moore) 252
Chrome Mordants and Chrome Dyes..... 281
Chrome Ooze Calf: Manufacture of (Jackson)..... 297
Chlorides in Warp Sizing..... 338
Classification: Benefits to Be Derived from a Standard Raw Silk (Lewis) 335
Cloths: Fine Wool Mixture ("An Old Cloth Raiser")..... 240
Cloth for Finishing: Preparation of (Higgins and Hodge)..... 276
Cloth for Finishing: Preparation of..... 174
Colors: American-Made
[See under "American"]
Colors: Direct (Greenhalgh)..... 172
Color Matching: Worsted (Kershaw)..... 246
Colors: The Mordanting of Worsted Piece Dyes for Certain Fast Chrome (Moore) 252
Colors: Notes on Some Effects Produced Through the Printing of Basic (Sansone) 86
Colors and Tints on Carpet and Rug Yarns: Bright (Holden)..... 209
Colors Fast to Bleaching (Schwarz)..... 222
Consideration of the Various Substances Used in the Construction of Dyeing and Bleaching Utensils and Apparatus: A (Grandage and Hadley)
Part I 41
Part II 73
Part III 112
Control of Dyestuffs: Chemical (Scott)..... 225
Cotton Piece Goods: Bleaching of (Bailey)..... 122
Cotton: Gain or Loss of Weight in Dyeing and Bleaching..... 366
Cotton Piece Goods: Notes on the Dyeing of Direct Blacks on (Sansone)
[See under "Notes"]
Cotton Piece Goods on the Padder: Dyeing (Deady)..... 333
Cotton Piece Goods: Practical Dyeing of (Alling and Brainerd).... 369
Cotton Softeners (Estey)..... 299
Cotton Warp Dyeing: Yarn Breakage in (Sidebottom)..... 4
Cotton Warps: Naphthol AS and BS and Their Use in the Dyeing of (Morris) 215
Cotton Yarn: High Polish for..... 424
Covering Vegetable Fibers in Woolen Piece Goods (Sanderson)..... 43

D

Subject — Page

Defects Developed During Wool Cloth Finishing (Midgley) 87
Direct Blacks on Cotton Piece Goods: Notes on the Dyeing of (Sansone)
[See under "Notes"]
Direct Colors (Greenhalgh) 172
Direct Colors: List of American
[See under "American-Made"]
Discharge Styles: Turkey Red (Wilson) 158
Discussion of Washing Standards on Silk (A. A. T. C. C.) 348
Dye Division, A. C. S., Spring Meeting, 1922: Abstracts of Papers .. 265
Dyehouse: Efficiency in the Worsted (B. T. C.)
[See under "Efficiency"]
Dyehouse: Lime in the (Darling) 323
Dyeing: A Quarter Century of Technical Education in Textile Chemistry and (Olney) 181
Dyeing and Bleaching Cotton: Gain or Loss of Weight in 366
Dyeing and Bleaching Utensils and Apparatus: A Consideration of the Various Substances Used in the Construction of (Grandage and Hadley)
[See under "Consideration"]
Dyeing and Calico Printing: Chromates of Lead in (Nanson) 467
Dyeing of Cellulose Acetate Silk (Sanderson) 6
Dyeing Cotton Piece Goods on the Padder (Deady) 333
Dyeing of Cotton Piece Goods: Practical (Alling and Brainerd) 369
Dyeing of Cotton Warps: Naphthol AS and BS and Their Use in the (Morris) 215
Dyeing: Formic Acid and (G. H. Johnson) 1
Dyeing with Indigo 306
Dyeing Material Containing Pulled Wool to Which Particles of Skin Adhere (Templeton) 9
Dyeing of Mixtures Containing Artificial Silk (Emmons) 268
Dyeing: Hosiery (Brainerd, A. T., and Brainerd, W. E.) 441
Dyeing: Multi-Color Effects in Simple Piece (Cross) 377
Dyeing: Physical Chemistry of (Briggs and Bull) 447
Dyeing: Preparation of Woolens for Piece (Everett) 300
Dyeing Sweat Pad Goods (Wilkinson) 357
Dyeing: Time and Temperature Control in Piece (Incoll) 13
Dyeing Tussah Silk: Bleaching and (Emmons) 463
Dyeing Viscose Silk (Emmons) 79
Dyeing Wool-Silk Materials the Same Shade (Emmons) 399
Dyeing Worsted Fabrics (Matos) 152
Dyeing: Yarn Breakage in Cotton Warp (Sidebottom) 4
Dyers Should Insist on a Report on the Quality of Raw Silk: Why Silk (Lewis) 151
Dyes: Chrome Mordants and Chrome 281
Dyes to Light: Summary of Progress of Investigators to Determine Fastness of (A. A. T. C. C.) 382
Dyes and Their Names 423
Dyes and Their Fastness to Light Under the Quartz Mercury Arc Lamp: Testing of (A. A. T. C. C.) (Robinson) 384
Dyes Used for Tinting White Goods in Laundries: Blue 130
Dyes on Silk: The True Alizarine (Emmons) 160
Dyestuff Industry as Seen from a Dyestuff Laboratory: Some Aspects of the (Rose) 221
Dyestuffs: Chemical Control of (Scott) 225
Dyestuffs: The Merchandising of (Claflin) 261
Dyestuffs: The New Physics, and the Chemistry of (Claflin) 219
Dyestuffs: The Practical Examination of (Sidebottom) 248

E

EDITORIALS—
The New Trend in Dyestuff Advertising 22
A Lesson from Manchester in Business Ethics 23
Drifting 55
Some Aspects of "The Chemical Question" 99
The 1921 Dye Census 133
The English Color Index 134
A Warning Which Should Be Heeded 134
An Invitation to the A. A. T. C. C. Members 167
The Senate Dye Decision 167
Welcome 199
Executives for the American Dye Industry 199
Dr. Jokichi Takamine: A Tribute 200
The Die Is Cast 254
The Ninth Chemical Show? 254
Our Fifth Anniversary 291
The Need of the Hour 292
Herman A. Metz 293
Foreign Recognition of a Necessity 327
Chemical Education 355
A Chance to Save the 1923 Chemical Show? 356
The Wrong Road to Harmony 387
The Reporter Index, the Proceedings Index—and an Announcement 459
A Useful Organization Arrives 459
Efficiencies: Observations on Textile (Chambers) 127
Efficiency in the Worsted Dyehouse (B. T. C.)—
Part I 37
Part II 75
Eosines: List of American
[See under "American-Made"]
Examination of Dyestuffs: The Practical (Sidebottom) 248
Extractors: Centrifugal (Hadley and Grandage) 193

F

Fabrics: Dyeing Worsted (Matos) 152
Fast to Bleaching: Colors (Schwarz) 222
Fast Chrome Colors: The Mordanting of Worsted Piece Dyes for Certain (Moore) 252
Fastness of Dyes to Light: Summary of Progress of Investigators to Determine (A. A. T. C. C.) 382
Fastness: German Tests for 18
Fibers: New Protective Agent for Animal (Edge) 52
Fine Wool Mixture Cloths ("An Old Cloth Raiser") 240
Finish: The Velour 205
Finishing: Defects Developed During Wool Cloth (Midgley) 87
Finishing of Fine Worsteds and Woolens: The (Jackman) 163
Finishing Plant Production: Increasing (Reoch) 81
Finishing: Preparation of Cloth for (Higgins and Hodge) 276
Finishing: Preparation of Cloth for 174
Flax and Research: German (Goldthwait) 228
FOREIGN TRADE OPPORTUNITIES 57, 135
Formic Acid and Dyeing (G. H. Johnson) 1
Fur Dyes: List of American
[See under "American-Made"]

G

Subject — Page

Gain or Loss of Weight in Dyeing and Bleaching Cotton 366
German Flax and Research (Goldthwait) 228
German Tests for Fastness 18

H

High Polish for Cotton Yarn 424
Hosiery Dyeing (Brainerd, A. T., and Brainerd, W. E.) 441
Hydrogen Peroxide: Manufacture and Application of (Wilson) 137

I

Increasing Finishing Plant Production (Reoch) 81
Indigo: Dyeing with 306
Induline: American
[See under "American-Made"]
INQUIRY DEPARTMENT—
Dyeing Sulphur Blacks 29
Testing Fabrics 30

L

Lamp: Testing of Dyes and Their Fastness to Light Under the Quartz Mercury Arc (A. A. T. C. C.) (Robinson) 384
Laundries: Bleaching in 325
Laundry Industry: Chemical Research in the Power (Shupp) 336
LICENSES FOR DYE IMPORTS GRANTED BY U. S. TREASURY DEPARTMENT—
July, 1922 177
August, 1922 257
Lime in the Dyehouse (Darling) 323
Lime in the Textile Industry (Darling) 16

M

Management: Principles of Organization and (Attwood) 47
Manufacture and Application of Hydrogen Peroxide (Wilson) 137
Manufacture of Chrome Ooze Calf (Jackson) 297
Matching: Worsted Color (Kershaw) 246
Mechanical Appliances for Pumping Chemical Solutions (Fischer)—
Part I 301
Part II 339
Part III 401
MEN OF MARK IN THE DYESTUFF FIELD—
Charles F. Goldthwait 202
Merchandising of Dyestuffs: The (Claflin) 261
Microscope in the New Bedford Textile School: Use of the (Grimshaw) 275
Microscope in Textile Work: Use of the (Abstract) (Hoxie) 347
Milling: Scouring and (Schofield) 243
Mixtures Containing Artificial Silk: Dyeing of (Emmons) 268
Mordanting of Worsted Piece Dyes for Certain Fast Chrome Colors: The (Moore) 252
Mordants (Bancroft)—
Part I 145
Part II 211
Part III 391
Mordants and Chrome Dyes: Chrome 281
Multi-Color Effects in Simple Piece Dyeing (Cross) 377

N

Naphthol AS and BS and Their Use in the Dyeing of Cotton Warps (Morris) 215
New Protective Agent for Animal Fibers (Edge) 52
Nigrosines: List of American
[See under "American-Made"]
Notes on the Dyeing of Direct Blacks on Cotton Piece Goods (Sansone)—
Part I [Vol. X, p. 402]
Part II 115
Part III 189
Part IV 471
Notes on Some Effects Produced Through the Printing of Basic Colors (Sansone) 86

O

Observations on Textile Efficiencies (Chambers) 127
Oil Colors: List of American
[See under "American-Made"]
Organization and Management: Principles of (Attwood) 47
"Oxycellulose": Its Formation and Reactions. (Summary of Literature.) (Clifford and Fargher) 405

P

Padder: Dyeing Cotton Piece Goods on the (Deady) 333
PATENTS—
Logwood Dyeing 32
Knitted Hosiery 32
Process for Producing Color Effects 35
Dark Dye Combined with Soap, and Process of Producing 36
Stop Mechanism for Looms 58
Process of Expanding the Cross-Sections of Spun Silk Yarn 59
Cloth Tinting Composition and Process of Tinting Cloth 60
Azo Dye 61
Process of Disintegrating Vegetable Fibers for Use in the Textile and Paper Industries 62
Production of Pattern Effects in Cotton and Other Vegetable Fiber Fabrics, Including Silk 62
Fabric-Measuring and Cost-Computing Machine 101
Cloth-Treating Machine 103
Peroxide as a Bleaching Agent: Sodium (Nanson) 419

Subject	Page
Physical Chemistry of Dyeing (Briggs and Bull)	447
Physics, and the Chemistry of Dyestuffs: The New (Claflin)	219
Piece Dyeing: Multi-Color Effects in Simple (Cross)	377
Piece Dyeing: Preparation of Woolens for (Everett)	300
Piece Dyeing: Time and Temperature Control in (Incoll)	13
Piece Dyes for Certain Fast Chrome Colors: The Mordanting of Worsted (Moore)	252
Piece Goods: Bleaching of Cotton (Bailey)	122
Piece Goods: Covering Vegetable Fibers in (Sanderson)	43
Piece Goods: Notes on the Dyeing of Direct Blacks on Cotton (Sansone) [See under "Notes"]	
Piece Goods on the Padder: Dyeing Cotton (Deady)	333
Piece Goods: Practical Dyeing of Cotton (Alling and Brainerd)	369
Practical Dyeing of Cotton Piece Goods (Alling and Brainerd)	369
Practical Examination of Dyestuffs: The (Sidebottom)	248
Preparation of Cloth for Finishing (Higgins and Hodge)	276
Preparation of Cloth for Finishing	174
Preparation of Woolens for Piece Dyeing (Everett)	300
PROCEEDINGS OF THE AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS	309, 345, 379, 451
Index to Proceedings	457
Principles of Organization and Management: The (Attwood)	47
Pumping Chemical Solutions: Mechanical Appliances for (Fischer) [See under "Mechanical"]	
Printing: Chromates of Lead in Dyeing and Calico (Nanson)	467

R

Raw Silk Classification: Benefits to Be Derived from a Standard Raw Silk (Lewis)	335
Research: German Flax and (Goldthwait)	228
Research in the Power Laundry Industry: Chemical (Shupp)	336
REVIEWS—	
Bleaching and Dyeing of Jute	31
Dyes, Classified by Intermediates	31
Dyeing Unions Containing Cellulose Acetate Silk	31
Analysis of Woven Fabrics	31
Principles and Practice of Fur Dressing and Fur Dyeing	56
Yarn Printing Machines	57
Rugs: Shampooing (Goldthwait)	109
Rug Yarns: Bright Colors and Tints on Carpet and (Holden)	209

S

Scouring and Milling (Schofield)	243
Scouring Worsted Goods	84
Shade: Dyeing Wool-Silk Materials the Same (Emmons)	399
Shampooing Rugs (Goldthwait)	109
Silk: Bleaching and Dyeing Tussah (Emmons)	463
Silk Classification: Benefits to Be Derived from a Standard Raw (Lewis)	335
Silk: Discussion of Washing Standards on (A. A. T. C. C.)	348
Silk: Dyeing of Cellulose Acetate (Sanderson)	6
Silk: Dyeing of Mixtures Containing Artificial (Emmons)	268
Silk: Dyeing Viscose (Emmons)	79
Silk Dyers Should Insist on a Report on the Quality of Raw Silk: Why (Lewis)	151
Silk and Its Applications in the Textile Industry: Artificial (King)	317
Silk Materials the Same Shade: Dyeing Wool- (Emmons)	399
Silk: Some Recent Important Developments in Artificial	155
Silk: The True Alizarine Dyes on (Emmons)	160
Sizing: Chlorides in Warp	338
Sodium Peroxide as a Bleaching Agent (Nanson)	419
Softeners: Cotton (Estey)	299
Solutions: Mechanical Appliances for Pumping Chemical (Fischer) [See under "Mechanical"]	
Some Aspects of the Dyestuff Industry as Seen from a Dyestuff Laboratory (Rose)	221
Some Recent Important Developments in Artificial Silk	155
Sulphur Colors: List of American [See under "American-Made"]	
Sulphuric Acid and Aluminum Chloride Processes: Carbonizing Raw Wool and Noils by the ("Consulting Textile Chemist")	187
Sweat Pad Goods: Dyeing (Wilkinson)	357

T

Subject	Page
Technical Education in Textile Chemistry and Dyeing: A Quarter Century of (Olney)	181
Temperature Control in Piece Dyeing: Time and (Incoll)	13
Testing of Dyes and Their Fastness to Light Under the Quartz Mercury Arc Lamp (A. A. T. C. C.) (Robinson)	384
Textile Chemistry and Dyeing: A Quarter Century of Technical Education in (Olney)	181
Textile Efficiencies: Observations on (Chambers)	127
Textile Industry: Artificial Silk and Its Applications in the (King)	317
Textile Industry: Lime in the (Darling)	16
Textile School: Use of the Microscope in the New Bedford (Grimshaw)	275
Textile Work: Use of the Microscope in (Abstract) (Hoxie)	347
Textiles: A Chemical Industry (Goldthwait)	207
THINGS EVERY TEXTILE CHEMIST AND COLORIST SHOULD KNOW—	
No. 6—Chlorinated Wool	42
No. 7—Mercerization and the Action of Chlorinated Alkalis on Cotton	113
No. 8—The Soxhlet Extractor	307
Time and Temperature Control in Piece Dyeing (Incoll)	13
True Alizarine Dyes on Silk: The (Emmons)	160
Turkey Red Discharge Styles (Wilson)	158

U

Use of the Microscope in the New Bedford Textile School (Grimshaw)	275
Use of the Microscope in Textile Work (Abstract) (Hoxie)	347

V

Vat Colors: List of American [See under "American-Made"]	
Velour Finish	205
Viscose Silk: Dyeing (Emmons)	79

W

Warp Sizing: Chlorides in	338
Washing Standards on Silk: Discussion of (A. A. T. C. C.)	348
White Goods in Laundries: Blue Dyes Used for Tinting	130
Why Silk Dyers Should Insist on a Report on the Quality of Raw Silk (Lewis)	151
Wool Cloth Finishing: Defects Developed During (Midgley)	87
Wool Mixture Cloths: Fine ("An Old Cloth Raiser")	240
Wool to Which Particles of Skin Adhere: Dyeing Material Containing Pulled (Templeton)	9
Wool and Noils by the Sulphuric Acid and Aluminum Chloride Processes: Carbonizing Raw ("Consulting Textile Chemist")	187
Wool-Silk Materials the Same Shade: Dyeing (Emmons)	399
Woolen Piece Goods: Covering Vegetable Fibers in (Sanderson)	43
Woolens: The Finishing of Fine Worsteds and (Jackman)	163
Woolens for Piece Dyeing: Preparation of (Everett)	300
Worsted Color Matching (Kershaw)	246
Worsted Dyehouse: Efficiency in the (B. T. C.) [See under "Efficiency"]	
Worsted Fabrics: Dyeing (Matos)	152
Worsted Goods: Scouring	84
Worsted Piece Dyes for Certain Fast Chrome Colors: The Mordanting of (Moore)	252
Worsteds and Woolens: The Finishing of Fine (Jackman)	163

Y

Yarn Breakage in Cotton Warp Dyeing (Sidebottom)	4
Yarn: High Polish for Cotton	424
Yarns: Bright Colors and Tints on Carpet and Rug (Holden)	209

Author Index

Author	Page
"A CONSULTING TEXTILE CHEMIST"— Carbonizing Raw Wool and Noils by the Sulphuric Acid and Aluminum Chloride Processes	187
ALLING, M. W.— The Practical Dyeing of Cotton Piece Goods (in collaboration with C. L. BRAINERD)	369
"AN OLD CLOTH RAISER"— Fine Wool Mixture Cloths	240
ATTWOOD, WALLACE— Principles of Organization and Management	47
"B. T. C."— Efficiency in the Worsted Dyehouse: Part I	37
Part II	75
BAILEY, WILLIAM A.— Bleaching of Cotton Goods	122
BANCROFT, WILDER D.— Mordants: Part I	145
Part II	211
Part III	391
BRAINERD, ARTHUR T.— Hosiery Dyeing (in collaboration with WALTER E. BRAINERD)	441
BRAINERD, C. L.— The Practical Dyeing of Cotton Piece Goods (in collaboration with M. W. ALLING)	369
BRAINERD, WALTER E.— Hosiery Dyeing (in collaboration with ARTHUR T. BRAINERD)	441
BRIGGS, T. R.— Physical Chemistry of Dyeing (in collaboration with ARTHUR W. BULL)	447
BULL, ARTHUR W.— Physical Chemistry of Dyeing (in collaboration with T. R. BRIGGS)	447
CHAMBERS, E. V.— Observations on Textile Efficiencies	127
CLAFLIN, ALAN B.— The Merchandising of Dyestuffs	261
The New Physics, and the Chemistry of Dyestuffs	219
CLIFFORD, PERCY HERBERT— "Oxycellulose": Its Formation and Reactions. A Summary of the Literature (in collaboration with ROBERT GEORGE FARGHER)	405
CROSS, REX— Multi-Color Effects in Simple Piece Dyeing	377

Author	Page
DARLING, ELTON R.—	
Lime in the Dyehouse	323
Lime in the Textile Industry	16
DEADY, WILLIAM F.—	
Dyeing Cotton Piece Goods on the Padder	333
EDGE, ALFRED—	
The New Protective Agent for Animal Fibers	52
EMMONS, GEORGE—	
Dyeing of Mixtures Containing Artificial Silk	268
Dyeing Wool-Silk Materials the Same Shade	399
Dyeing Viscose Silk	79
The True Alizarine Dyes on Silk	160
ESTEY, P. F.—	
Cotton Softeners	299
EVERETT, CHARLES A.—	
Preparation of Woolens for Piece Dyeing	300
FARGHER, ROBERT GEORGE—	
"Oxycellulose": Its Formation and Reactions. A Summary of the Literature (in collaboration with PERCY HERBERT CLIFFORD)	405
FISCHER, A. K.—	
Mechanical Appliances for Pumping Chemical Solutions:	
Part I	301
Part II	339
Part III	401
GOLDTHWAIT, CHARLES F.—	
German Flax and Research	228
Shampooing Rugs	109
Textiles: A Chemical Industry	207
GRANDAGE, H.—	
Centrifugal Extractors (in collaboration with W. E. HADLEY)	193
A Consideration of the Various Substances Used in the Construction of Dyeing and Bleaching Utensils and Apparatus (in collaboration with W. E. HADLEY):	
Part I	41
Part II	73
Part III	112
GREENHALGH, E.—	
The Direct Colors	172
GRIMSHAW, ALBERT H.—	
Use of the Microscope in the New Bedford Textile School	275
HADLEY, W. E.—	
Centrifugal Extractors (in collaboration with H. GRANDAGE)	193
A Consideration of the Various Substances Used in the Construction of Dyeing and Bleaching Utensils and Apparatus (in collaboration with H. GRANDAGE):	
Part I	41
Part II	73
Part III	112
HIGGINS, H. S.—	
Preparation of Cloth for Finishing (in collaboration with ANDREW HODGE)	276
HODGE, ANDREW—	
Preparation of Cloth for Finishing (in collaboration with H. S. HIGGINS)	276
HOLDEN, FRANK C.—	
Bright Colors and Tints on Carpet and Rug Yarns	209
HOXIE, FREDERICK J.—	
Use of the Microscope in Textile Work (Abstract)	347
INCOLL, NORPUT—	
Time and Temperature Control in Piece Dyeing	13
JACKMAN, A.—	
The Finishing of Fine Worsteds and Woolens	163
JACKSON, WILLIAM C.—	
The Manufacture of Chrome Ooze Calf	297
JOHNSON, GEORGE H.—	
Formic Acid and Dyeing	1
KERSHAW, SAMUEL—	
Worsted Color Matching	246
KING, P. E.—	
Artificial Silk and Its Applications in the Textile Industry	317
LEWIS, L. C.—	
Benefits to Be Derived from a Standard Raw Silk Classification	335
Why Silk Dyers Should Insist on a Report on the Quality of Raw Silk	151
MATOS, LOUIS J.—	
Dyeing Worsted Fabrics	152
MIDGLEY, EBER—	
Defects Developed During Wool Cloth Finishing	87
MOORE, KARL R.—	
The Mordanting of Worsted Piece Dyes for Certain Fast Chrome Colors	252
MORRIS, MERRILL G.—	
Naphthol AS and BS, and Their Use in the Dyeing of Cotton Warps	215
NANSON, WILLIAM B.—	
Sodium Peroxide as a Bleaching Agent	419
OLNEY, LOUIS A.—	
A Quarter Century of Technical Education in Textile Chemistry and Dyeing	181
REOCH, R. A. S.—	
Increasing Finishing Plant Production	81
ROBINSON, S. W.—	
The Testing of Dyes and Their Fastness to Light Under the Quartz Mercury Arc Lamp	384
ROSE, ROBERT E.—	
Some Aspects of the Dyestuff Industry as Seen from a Dyestuff Laboratory	221
SANDERSON, W. E.—	
Covering Vegetable Fibers in Woolen Piece Goods	43
Dyeing of Cellulose Acetate Silk	6
SANSONE, RAFFAELE—	
Notes on Backcloths	425
Notes on the Dyeing of Direct Blacks on Cotton Piece Goods:	
Part I (Vol. X, p. 402)	
Part II	115
Part III	289
Part IV	471
Notes on Some Effects Produced Through the Printing of Basic Colors	86
SCHOFIELD, J.—	
Scouring and Milling	243
SCHWARZ, H. F.—	
Colors Fast to Bleaching	222
SCOTT, WALTER M.—	
Chemical Control of Dyestuffs	225
SHUPP, A. F.—	
Chemical Research in the Power Laundry Industry	336
SIDEBOTTOM, LEON W.—	
The Practical Examination of Dyestuffs	248
Yarn Breakage in Cotton Warp Dyeing	4
TEMPLETON, GEORGE E.—	
Dyeing Material Containing Pulled Wool to Which Particles of Skin Adhere	9
WILKINSON, J.—	
Dyeing Sweat Pad Goods	357
WILSON, H.—	
Manufacture and Application of Hydrogen Peroxide	137
WILSON, J. A.—	
Turkey Red Discharge Styles	158

Proceedings of the American Association of Textile Chemists and Colorists

American Association of Textile Chemists and Colorists

INDEX

TO

PROCEEDINGS

From the Inaugural Meeting, November 3, 1921, to Material Published December 18, 1922

[*Does Not Include Second Annual Meeting*]

[*Note—For the convenience of members desiring to bind Proceedings separately, references in this Index are by Association page numbers, found at the* bottom *of each page, and running consecutively from* 1 *to* 100.]

A

Page

ABSTRACTS—
Mercerization (Chase) 32
Water Purification for Textile Purposes (Weston) 46
Some Chemical Aspects of Waterproofing and Mildew-Proofing Textile Fabrics (Adams) 56
Electrometric Titration as a Means of Determining the Free Sodium Sulphide in a Sulphur Black Dye Bath (Russell and Arnold) 68
Use of the Microscope in Textile Work (Hoxie) 87

Amsden, James L.: Death of 44

ASSOCIATION—
Inaugural Meeting 1
Constitution 13
Charter Members 16, 25, 51
Advance Program of Second Annual Meeting 90
Proposed Amendments to Constitution 90

AUTHORS—
Biery, Thomas J.:
Shaded Goods 60
Bume, Louis F.:
The Causes for Shady and for Cloudy Goods 59
Haskell, Walter F.:
Some Experiences with Uneven Warp Dyeing 61
Johnson, Frank E.:
Some Causes of Shadedness and Cloudedness 62
Murray, Wallace J.:
Differential Reduction of Vat Dyes 25
Bibliography of Literature on the Fastness of Dyes 39
Color Reactions for the Identification of Anthracene Vat Dyes 43
Development of Tests for the Fastness of Dyestuffs 51
Putnam, Leverett N.:
Experiences with Shady Piece Goods 63
Robinson, S. W.:
Testing of Dyes and Their Fastness to Light Under the Quartz Mercury Arc Lamp 94
Spencer, Frederick:
Causes of Unevenness in Top Dyeing 64

B

BOSTON SECTION—
Formation of 23
Organization Meeting 45

C

COMMUNICATIONS—
From the President 21
From the President 78
CORRESPONDENCE—
Louis A. Olney 29
A. Silverwood 30
Louis A. Olney 33
COUNCIL—
First Meeting 15
Second Meeting 22
Third Meeting 33
Fourth Meeting 41
Fifth Meeting 49
Sixth Meeting 53
Seventh Meeting 69
Eighth Meeting 80
Ninth Meeting 82
Tenth Meeting 89

Proceedings of the American Association of Textile Chemists and Colorists

D

Page

Discussion of Washing Standards on Silk 88

N

NEW YORK SECTION—
Formation of 34
Organization Meeting 38
Meeting, April 21, '22 57
Meeting, October 20, '22 83
NORTHERN NEW ENGLAND SECTION—
First Meeting ("Experience Meeting") 59
Meeting, October 21, '22 85

P

PAPERS—
Differential Reduction of Vat Dyes (Murray) 25
Bibliography of Literature on the Fastness of Dyes (Murray) 39
Color Reactions for the Identification of Anthracene Vat Dyes (Murray) 43
Development of Tests for the Fastness of Dyestuffs (Murray) 51
Causes for Shady and for Cloudy Goods (Bume) 59
Shaded Goods (Biery) 60
Some Experiences with Uneven Warp Dyeing (Haskell) 61
Some Causes of Shadedness and Cloudedness (Johnson) 62
Experiences with Shady Piece Goods (Putnam) 63
Causes of Unevenness in Top Dyeing (Spencer) 64
Testing of Dyes and Their Fastness to Light Under the Quartz Mercury Arc Lamp (Robinson) 94
PHILADELPHIA SECTION—
Formation 73
Organization Meeting 91

Q

Page

Quin, E. G.: In Memoriam 84

R

RESEARCH COMMITTEE—
First Meeting 22
Second Meeting 36
Third Meeting 42
Fourth Meeting 50
Fifth Meeting 58
Provisional Method on Fastness of Dyed Wool to Fulling, Scouring and Washing 54
Sixth Meeting 69
Provisional Method on Fastness of Dyed Silk to Washing, Scouring and Fulling 70
Seventh Meeting 74
Provisional Method on Fastness to Washing, Soaping, Laundering and Fulling of Dyed and Printed Cotton Against White Cotton 75
Eighth Meeting 81
RHODE ISLAND SECTION—
Formation of 16
Inaugural Meeting 31
Second Meeting 43
Joint Meeting with R. I. Section, A. C. S. 56
Meeting, October 20, '22 86

S

Summary of Progress Made by Various Investigators in an Effort to Standardize Methods for Determining the Fastness of Dyes to Light 92

Established 1895

BOSSON & LANE

Manufacturers of

The Original

BLEACHING OIL

for boiling out Cotton, to produce a foundation for a Pure White

High Grade Sulphonated and Saponified

CASTOR OIL PRODUCTS

Para Soap Oil

Solvents and Assistants for cleaning all Textiles

B & L Bleachers' Bluings and Tints

Works and Office, ATLANTIC, MASS.

ATLANTIC PATENT BLACK

THE UNRIVALED SULPHUR BLACK that "STAYS BLACK"

SOLUBLE FAST BLOOMY BRILLIANT

An intense fast Black, possessing the greatest solubility superior and lasting bloom and brilliancy and thorough penetration

ECONOMY

The low percentage required to produce a deep black substantiates the claim for economy of use

UNIFORMITY

Uniformity of Atlantic Products is best exemplified by repeat orders which specify "SAME AS LAST SHIPPED"

ATLANTIC YELLOWS
ATLANTIC BLUES
ATLANTIC BROWNS
ATLANTIC MAROONS
ATLANTIC GREENS

ATLANTIC DYESTUFF COMPANY
Portsmouth N.H.
New York Charlotte Chicago Philadelphia Providence

AGAIN AVAILABLE

WHITTAKER'S BOOK

"The Testing of Dyestuffs in the Laboratory"

THE eighth importation of this newest and most popular work by Mr. Whittaker has arrived and back orders are now being filled. We have a small surplus which are available for immediate shipment to those who act promptly.

"The Testing of Dyestuffs in the Laboratory" presents in condensed form the results of over twenty years' practical experience. It deals in general with the dyestuff testing laboratory and its functions and in particular with methods for the testing and evaluation of the different types of dyestuff, including the natural colors. Every dye chemist should order his copy NOW to insure early delivery.

PRICE $4.50, POSTAGE PAID

HOWES PUBLISHING COMPANY

4109 Woolworth Building NEW YORK CITY

1816 CHEMICALS 1922

"Over a Century of Service and Progress"

BLEACHING POWDER

FINISHING MATERIALS

FORMIC ACID

COLORS

GUMS and WAXES

DYESTUFFS **CAUSTIC SODA**

INNIS, SPEIDEN & CO.

Manufacturers, Importers, Exporters of Industrial Chemicals

46 Cliff Street **New York**

BRANCHES:

Chicago Philadelphia Boston Cleveland
Gloversville, N. Y.

KLAUDER-WELDON

Dyeing - Bleaching - Scouring Machinery

There are K-W machines in use which were built nearly half a century ago and which are still doing their work efficiently and economically under severe service. This is sufficient evidence of the durability and capability of K-W Machines after long years of subjection to the ravages of live steam, heat and alkalis.

K-W Machinery by its accomplishments has steadily and irresistibly built up a reputation that has made the name "Klauder-Weldon" synonymous with the **"world's best dyeing, bleaching and finishing machinery."**

Our interest in upholding the K-W reputation means that you MUST be satisfied, and our suggestions to prospective purchasers are made with the view toward solving any dyeing, bleaching or scouring problem for all time. We will be glad to answer any and all questions without obligation on your part whatsoever.

Write today for K-W Literature

The Klauder-Weldon Dyeing Machine Co.

Bethayres, Pa., U. S. A.

H. G. Mayer, Southern Agent,
Realty Bldg., Charlotte, N. C.

Consult Us About Your Dyeing Problems

The services and advice of an expert chemist and a well equipped laboratory are at your disposal without cost, except when special research or experimentation is necessary, when the charges will be of a minimum nature.

American Dyestuff Reporter

Woolworth Bldg. **New York City**

RÖHM & HAAS CO.

Manufacturers of

CHEMICALS

40 North Front St., Philadelphia, Pa.

SPECIALTIES

LYKOPON—Concentrated Hydrosulphite for reducing Indigo and vat dyes.

FORMOPON—For discharge work.

FORMOPON EXTRA—For Stripping.

INDOPON W—Indigo Discharge Assistant.

TARTAR EMETIC—Technical.

CHEMICALS

Sodium Sulphide, Sodium Bisulphite, Sulphate of Alumina, Acids, &c.

When the Seals Come, Buy Them

A LITTLE before Christmas, you will be offered some Christmas Seals. Keep them and use them on envelopes and packages. Send a check or money order to cover the small sum they cost.

When you do this, you help in the fight against tuberculosis. You help save human lives. Your help goes where help is most needed —to the house that is clouded with the threat of death. When the seals come, buy them.

Stamp Out Tuberculosis with Christmas Seals

THE NATIONAL, STATE, AND LOCAL TUBERCULOSIS ASSOCIATIONS OF THE UNITED STATES

THE NEWPORT COLORS

Vat Dyes

THE SUN

is the greatest chemist in all the universe, and just as eons ago it instilled into vegetation the elements we now withdraw for the production of color from coal, so is it endowed with the power of destroying these selfsame colors. To the ingenuity of man falls the task of combating this, and as a result of the endeavors of the chemist the famous series known as the

NEWPORT ANTHRENES

has been developed.

Of these the following types are now on the market:

Newport Anthrene Blue RS	Newport Anthrene Yellow G
Newport Anthrene Blue GC	Newport Anthrene Brown BB
Newport Anthrene Blue GCD	Newport Anthrene Green B
Newport Anthrene Blue BSP	Newport Anthrene Jade Green
Newport Anthrene Blue BCS	Newport Anthrene Black B
Newport Anthrene Yellow R	Newport Anthrene Dark Blue BO

NEWPORT
REG U.S. PAT OFF
"COAL TO DYESTUFF"

NEWPORT CHEMICAL WORKS, Inc.

PASSAIC, NEW JERSEY

Branch Sales Offices:

BOSTON, MASS PHILADELPHIA, PA.
PROVIDENCE, R. I. GREENSBORO, N. C. CHICAGO, ILL.